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Sensitive Plants of San Nicolas Island, California (Phase 2)

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Steve Junak
William L. Halvorson
Cathy Schwemm
Thomas Keeney

Technical Report No. 57

United States Geological Survey
Cooperative Park Studies Unit
The University of Arizona ◆ Tucson, Arizona

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December 1996

United States Geological Survey
Cooperative Park Studies Unit
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Abstract

Field surveys were conducted on San Nicolas Island during the spring and summer of 1992 and 1993 to determine the distribution, habitat characteristics, and population status of 11 sensitive plant taxa. These taxa are restricted to the California Channel Islands, are of local concern, or have been identified as sensitive species by the United States Fish and Wildlife Service, the State of California, and/or the California Native Plant Society. An additional 14 sensitive taxa were mapped on San Nicolas Island during an earlier phase of this survey.

This survey provides baseline data against which future monitoring of these plants can be compared. All of these taxa have been negatively affected by past land use, including grazing and military uses of the island. In this report, we make taxon-specific recommendations on monitoring and other actions that should be taken for protection.

It is not the intent of this survey to make detailed predictions about the long-term stability or trends of these rare taxa, but only to identify their locations and known published data, and to set a reasonable schedule for gathering information on future population trends. Appropriate monitoring schemes differ depending on the status of individual taxa. Beyond periodic surveys to update taxa status, it is also recommended that intensive autecological studies be conducted on these 11 taxa to gain a better understanding of their ecological role in the island's ecosystems and of their population dynamics.

Introduction

The California Channel Islands are located off the coast of southern California (Fig. 1). These 8 islands represent the emergent portions of a complex system of submarine canyons and ridges in a geomorphic province referred to as the California Continental Borderland (Vedder 1976). The islands are natural areas known for windswept landscapes, rugged coastlines, and unspoiled beaches that are often teeming with marine mammals and birds. Their floras, rich in endemic species, have attracted the attention of botanists and horticulturists for more than a century.

The California Channel Islands are situated between 32° 48' and 34° 05' N latitude and between 118° 21' and 120° 27' W longitude, and range in size from 2.6 to 249 km². Maximum elevations on the islands vary from 194 to 753 m. Distances from the adjacent mainland range from 20 km (Anacapa Island) to 98 km (San Nicolas Island). The 8 islands in the chain have been divided into 2 major groups: (1) the Northern Channel Islands (San Miguel, Santa Rosa, Santa Cruz, and Anacapa); and (2) the Southern Channel Islands (Santa Barbara, San Nicolas, Santa Catalina, and San Clemente).

San Nicolas, the site of this study, is the most isolated of the Southern Channel Islands. It lies 98 km south-southwest of Ventura, with its center near 33° 15' N latitude, 119° 28' W longitude. The nearest neighboring island is Santa Barbara, 45 km to the northeast. San Nicolas is separated from Santa Barbara and the other islands in the chain by deep ocean channels. The other islands lie 80–96 km to the north and about 80 km to the east and southeast.

Approximately 58 sq km in size, San Nicolas is an oval-shaped island (Fig. 2) about 15.5 km long and 5.4 km wide. From the sea, the island presents a low, table-like profile. Its topography is dominated by a broad terrace or mesa with no distinctive peaks; this mesa covers most of the surface area of the island, being roughly 10.3 km long and 3.4 km wide (USGS 1:24,000 Topographic Map, San Nicolas Island, CA). The main axis of the island runs from northwest to southeast, and the mesa slopes gently to the northeast from the highest points, which are near the south rim of the terrace. The maximum elevation on the island is 277 m (at Jackson Peak).

Geology and Soils

According to Vedder and Norris (1963), San Nicolas Island is a broad, complexly faulted anticline that parallels the long dimension of the island, with its crest near the southwestern shoreline. The exposed Tertiary section on the island consists of nearly 1,067 m of alternating marine sandstone and siltstone beds that contain minor amounts of interbedded conglomerate and pebbly mudstone. Vedder and Norris divided this sedimentary rock sequence into 35 mappable units, all of Eocene age, and they reported that several small andesitic dikes of Miocene age intrude the sedimentary rocks near the southeastern end of the island. They found that dune sand and fossiliferous marine terrace deposits of Quaternary age cover most of the central and western parts of San Nicolas Island.

The U.S. Soil Conservation Service (1985) mapped 27 soil units on San Nicolas Island, including beach and dune sand; Jehemy clay; several sandy loams and loamy sands; rock outcrops; and eroded, channeled, and gullied complexes. Rock outcrops (1,497 ha), Vizcapoint severely eroded land complexes (514 ha), dune land (469 ha), and Vizcapoint sandy loam (437 ha) were identified as the most common soil types on the island.

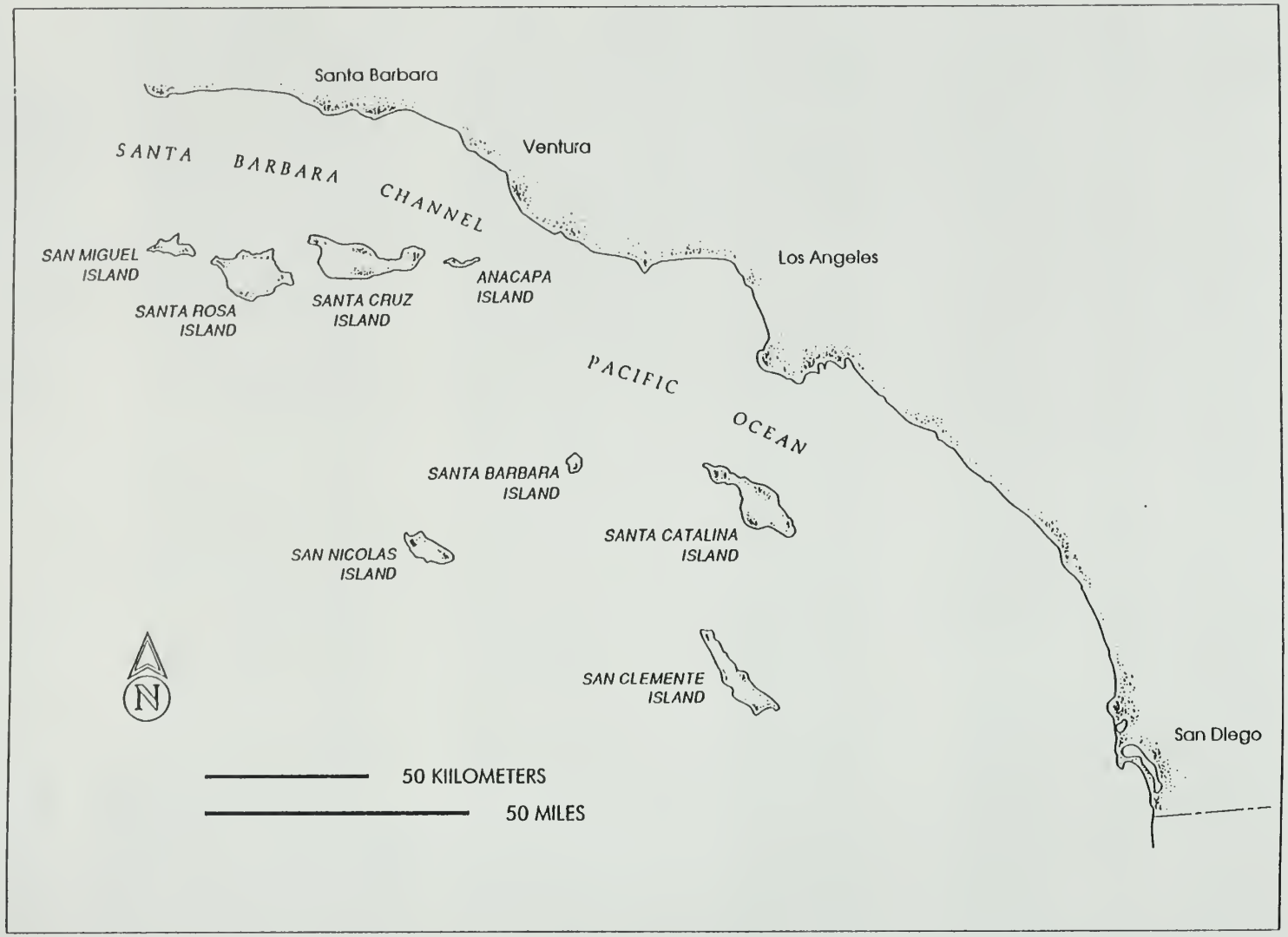

Figure 1. The 8 California Channel Islands and adjacent mainland.

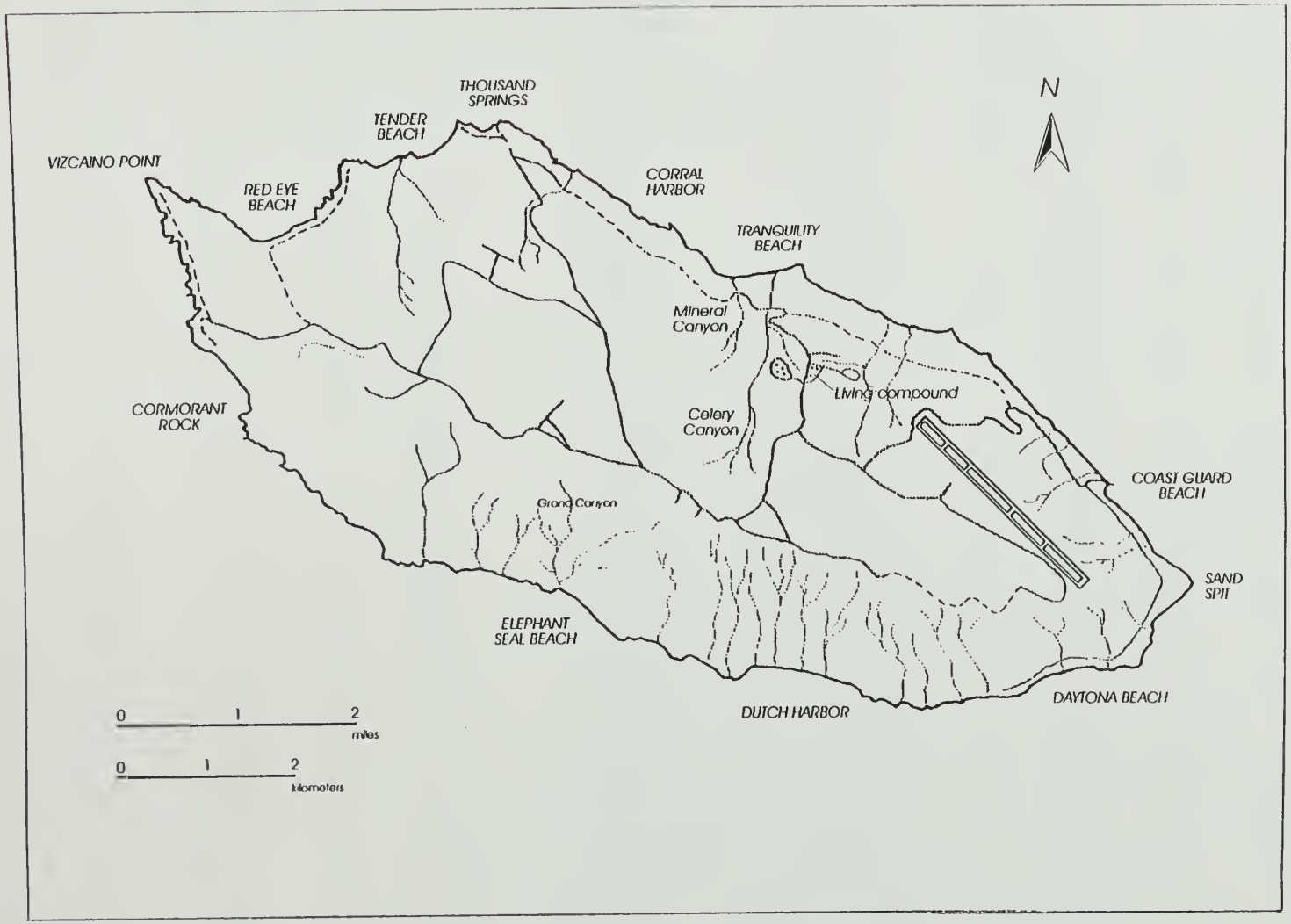

Figure 2. San Nicolas Island, California.

Climate

Climatic data, primarily of temperatures and precipitation, have been gathered on San Nicolas Island between September 1933 and August 1944 and continuously since 1947 (deViolini 1974). The climate of the island is characterized by a Mediterranean pattern of relatively warm, wet winters and cool, dry summers. A dominant feature of the island's weather is the prevailing northwest wind, which averages 14 knots per hour with an annual mean maximum of 52 knots.

Interactions between the strong winds, marine fogs, and the island's topography promote distinctive microclimatic zones that affect the distribution of individual species and of plant communities. Since the island presents an obstruction to the prevailing wind flow, the northern and western portions of the island may be covered by low stratus clouds if these low clouds are present over the adjacent waters, while the southern and eastern portions of the island may be clear (de Violini 1974).

Mean monthly temperatures vary only slightly, from about 12° C in January to about 18° C in September, being moderated by the surrounding ocean. Freezing temperatures have not been recorded on the island; the minimum of 0.5° C was recorded in January 1949 when a light snow fell. Temperatures above 38° C are occasionally experienced on the island; a 25-year maximum temperature of 40.5° C was recorded in September 1955 (de Violini 1974).

Mean annual precipitation on the island between 1948 and 1973 was 16.63 mm, with 73% of that amount falling between November and the end of February. The summer months average less than 0.25 mm, and most of what falls is drizzle from stratus clouds. Annual extremes of 6.68 mm and 34.26 mm were recorded in the 1960–61 and 1951–52 seasons respectively (de Violini 1974).

Relevant Land Use History

The following description of human activities on the island is intended to be a brief overview. For a more detailed history of sheep ranching activities, see Swanson (1993).

Like the other smaller islands off the coast of southern California, San Nicolas was not a Mexican land grant and eventually came under the jurisdiction of the Lighthouse Board of the U.S. Treasury Department. Illegal ranching began on the island by the middle of the 19th century and continued until just after the beginning of the 20th century. In 1902, the Lighthouse Board began to lease the island to agricultural users for 5-year periods at a time. As a result of ranching activities, introduced plants and grazing animals have had profound effects on the vegetation and flora of San Nicolas Island.

Because of the relatively gentle topography, virtually every square inch of the island has been accessible to grazing animals, and few areas have escaped decades of disturbance. The heaviest impacts apparently occurred in the 1860s and 1870s, when sheep numbers were highest and a series of dry years drove the animals to strip the island of vegetation. Sheep were present on San Nicolas from the 1850s in population sizes of between 500 and 15,000 animals. They were first

brought to the island by Captain Martin M. Kimberly in the late 1850s and multiplied for several years. According to Mrs. Kimberly (1988):

> Captain Kimberly stocked San Nicolas with sheep, and they increased very rapidly. The ewes had young twice a year and two were almost always born each time. The flocks increased until they numbered 15,000 . . .
>
> Then came the dry year of 1864, which dealt Captain Kimberly a very hard blow. There was no rain at all, and many of the sheep died. Another dry year, in 1869 or '70, turned San Nicolas into a desert and drove my husband out of the sheep business with heavy loss. In those days, San Nicolas was luxuriantly covered with vegetation, but the sheep, in their frantic efforts to get water, clipped off all that survived the dry, hot winds.
>
> The wild carrot [Coreopsis gigantea?], with long, strong roots which went far down into the soil, had moisture at the bottom of them and the sheep dug two or three feet into the ground to get at the bottom of them. The winds blew sand completely over the island, burying the roots and the seeds that remained so deep that they were smothered and have made the island simply a waste of yellow sand . . . Captain Kimberly saw that he would lose all his sheep unless he could get them off, so he chartered a large vessel and took the sheep, 1,000 at a time, to San Francisco, where he sold them to the butchers. The last 4,000 he could not get off and they remained on the island when he sold it to Mr. Hamilton, a San Francisco banker, in 1870 or '71.

Paul Schumacher (1877) visited San Nicolas Island in June 1875 and observed: "The vegetation is like that of San Miguel [Island], and also ruined by overstocking it with sheep, which are here found in a like starving condition. Near the house on the northeast side, we found some malva bushes [*Lavatera assurgentiflora*?] cleared of their foliage to the reach of sheep, which gave them the appearance of scrub oak trees when seen from a distance."

By 1876, the Pacific Wool Growing Association had obtained grazing rights to San Nicolas and Anacapa islands and reportedly owned 3,000 sheep and 400 lambs (Ventura Signal Supplement, 16 February 1876, Delinquent Tax List for year 1875–1876). In 1879, Stehman Forney reported that the island was occupied by H. D. Mills, who had about 2,000 head of sheep at that time (Forney 1879).

Blanche Trask visited San Nicolas Island in 1897 and saw "a cabin, a barn, shearing sheds, a cistern and a platform which drains its rain water into a reservoir." She surmised that "all these improvements are due to the once ambitious ranchmen who seem now to have abandoned the sheep; about 500 are occasionally seen . . ." (Trask 1900). Trask collected plant specimens on the island in 1897 and 1901; several species were found only in cactus clumps, which apparently protected them from the sheep (Eastwood 1898; Junak and Vanderwier 1990).

During the first half of the 20th century, sheep numbers apparently varied between 1,200 and 2,000 animals, until they were removed during World War II. Sebree and Davis (1901) reported 1,200 sheep on the island during their visit in September 1901. The U.S. Lighthouse Bureau leased the island to ranchers in 5-year increments between 1902 and 1934. Successful bidders for the leases included W. J. McGimpsey (1902–1907), D. R. Weller (1907–1909), J. G. Howland (1909–1919), and E. N. Vail (1919–1934).

Bryan (1970) visited San Nicolas Island in late 1926 and met a Captain Nelson, "the 76-year-old sheepherder (an ex-sea captain), who lived on the island 'tending' about 2,500 head of half-wild sheep."

Wheeler (1944) reported that "in past years some 2,500 head of sheep have been supported by the grass that grows on the high central plateau [of San Nicolas Island]. The sheep have been removed for the duration of the war [World War II]."

In 1933, the island was transferred to the U.S. Navy by Executive Order of President Hoover. In November 1942, the Army was given temporary jurisdiction over the island, and it became a gunnery range. San Nicolas Island was returned to the Navy following the end of World War II, and in 1947 the island came under the control of the Naval Air Station at Point Mugu as part of the Naval Air Missile Test Center (de Violini 1974).

Past land uses (including overgrazing by sheep) have affected the composition and distribution of plant communities and individual species on San Nicolas Island. The full extent of the changes are unknown because of the lack of biological monitoring and even periodic biotic surveys. It is assumed (and anecdotal evidence supports the hypothesis) that the island biota is slowly recovering from the grazing damage.

Since the ranching era ended, the impacts on the island's plant communities have been from Naval operations of building and road construction, accidental fires, borrow pits, erosion associated with roads and pipelines, and attempts at revegetation with introduced species. None of these activities are well documented.

Methods

This study, designed to be completed in 2 phases, was conducted to determine the distribution, habitat characteristics, and population status of selected plant taxa found on San Nicolas Island. Taxa included in the study are restricted to the California Channel Islands, are of local concern, or have been identified as sensitive species by the U.S. Fish and Wildlife Service, the State of California, and/or the California Native Plant Society. Three native bunchgrasses are of local concern because of their potential importance in the island's ecosystem recovery and because their habitats have been seriously degraded throughout southern California. One taxon (*Lepidium virginicum* var. *robinsonii*), which had previously been reported for the island (Howell 1935) and would have qualified as a sensitive species, was not included in the survey because the report was found to be unsubstantiated.

A total of 14 sensitive plant taxa were surveyed during Phase 1 of the project (Junak et al. 1995). An additional 11 taxa, surveyed during Phase 2 of the study, are included in this report. San Nicolas Island was surveyed in the spring and summer of 1992 and 1993 by 2 to 8 person teams walking across the island in a comprehensive and systematic manner. Locations and population counts or estimates were recorded for the 11 rare plant taxa included in Phase 2 of the study (see Table).

Data were recorded on standard U.S. Geological Survey (USGS) 1:24,000 topographic maps and/or 1:12,000 enlargements of those maps. Additionally, 1:12,000 true color aerial photographs with mylar overlays were used in data recording, providing a more precise location record of plant populations. Aerial photographs with standard overlap were taken on 9 January 1992 by Pacific Western Aerial Surveys (Flight # PW 44781). Field data were then transferred to 1:24,000 USGS topographic sheet "San Nicolas Island, CA" and to maps generated with the computer GIS program ArcInfo for this final report.

Table. Status of sensitive plants on San Nicolas Island, Ventura County, California (U.S. Fish and Wildlife Service 1993, Skinner and Pavlik 1994, and this study).

Sensitive plant species	Federal[1]	State[2]	CNPS list[3]	This study[4]
Aphanisma blitoides[5]	C-2	none	1B	Restricted; sporadic occurances
Artemisia nesiotica[6]	none	none	none	Locally common; stable
Atriplex pacifica[5]	C-2	none	1B	Restricted; sporadic occurances
Hordeum intercedens[5]	none	none	3	Locally common; sporadic occurances
Lepidium oblongum var. *insulare*[5]	none	none	none	Locally common; sporadic occurances
Nassella cernua[5]	none	none	none	Widespread; stable
Nassella lepida[5]	none	none	none	Restricted; stable
Nassella pulchra[5]	none	none	none	Restricted; stable
Orobanche parishii subsp. *brachyloba*[5]	C-1	C-1	1B	Widespread; stable
Trifolium microdon[5]	none	none	none	Restricted; sporadic occurances
Trifolium palmeri[6]	none	none	4	Restricted; sporadic occurances

Table. Legend and Definitions

1 = Federal

- E: Endangered; endangered of becoming extinct
- T: Threatened; threatened with becoming endangered
- C-1: Category 1 candidate; enough data to support listing
- C-2: Category 2 candidate; threat/distribution data are insufficient to support listing
- C-2*: Plants only; threat and/or distribution data are insufficient to support listing, but the plant is presumed extinct
- C-3a: Extinct
- C-3b: Taxonomically invalid
- C-3c: Too widespread and/or not threatened

2 = State of California

- CE: Endangered
- CT: Threatened
- CR: Rare

3 =California Native Plant Society

- List 1A: Plants presumed extinct in California
- List 1B: Plants rare, threatened, or endangered in California and elsewhere
- List 2: Plants, rare, threatened, or endangered in California but more common elsewhere
- List 3: Plants about which need more information - a review list
- List 4: Plants of limited distribution - a watch list

4 = This Study

5 = Taxon also found on mainland

6 = California island endemic on 2 or more of the Channel Islands

Discussion

The flora of the California Channel Islands includes significant numbers of plant taxa that have been introduced to southern California from other areas of the world. San Nicolas Island has the highest percentage (46%) of nonnative plants of all the California Channel Islands. The nonnative plants represent 28 families, 88 genera, and 118 taxa, and contribute significantly to the plant coverage on the island (Junak and Vanderwier 1990; Halvorson et al. 1996). These introductions have been associated primarily with disturbances caused by sheep grazing and military activities. Several are potentially invasive species and have recently been introduced to San Nicolas Island. Threats to the well-being of the sensitive native species in this report are disturbance from continued development and other military activities on the island, and the impacts from invasive nonnative plants.

Eighteen (ca. 14% of the native flora) plant taxa found on San Nicolas Island are endemic to the California Channel Islands. Of these, 4 have been found only on San Nicolas Island and 2 of these are now thought to be extinct. The island was systematically searched for 11 of the sensitive vascular plants. Populations of 5 of the 11 taxa were found to be widespread (or locally common) and healthy. We recommend that these 5 species be monitored by resurveying at least every 5 years. These surveys should include checking for population numbers within areas already identified and checking for any expansion or reduction of population sizes. The taxa in this status category are *Artemisia nesiotica*, *Nassella cernua*, *Nassella lepida*, *Nassella pulchra*, and *Orobanche parishii* subsp. *brachyloba*.

Six annual taxa were found to have restricted distributions with sporadic occurances. These should be monitored by annual surveys for the next 5 years, to assess population size variability and trends. The taxa in this status category are *Aphanisma blitoides*, *Atriplex pacifica*, *Hordeum intercedens*, *Lepidium oblongum* var. *insulare*, *Trifolium microdon*, and *Trifolium palmeri*. *Hordeum intercedens* and *Lepidium oblongum* var. *insulare* were locally common in some areas.

Beyond periodic surveys to update taxa status, we also recommend that intensive autecological studies be conducted on these 11 taxa to gain a better understanding of their ecological role and population dynamics. Such studies could include population density changes from site to site, studies of seed production, germination requirements, and seedling establishment, studies of flower pollination and pollinators, studies of habitat attributes related to population sizes, demographic studies of perennial taxa, and experimental transplants.

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Species Accounts

Botanical name: *Aphanisma blitoides* Nutt. ex Moq.

Common name: Aphanisma

Family: Chenopodiaceae

Listing status

Federal: C2
State: Not listed
CNPS: 1B (Skinner and Pavlik 1994)

Description

Aphanisma blitoides is a succulent annual branching from the base, with slender stems that are decumbent or ascending, 1–7 dm long (Figs. 3 and 4). The leaves are alternate, entire, the upper ovate, mostly sessile or subsessile, or the lower longer and petioled and oblanceolate to oblong, 1–2.5 cm long. The flowers are perfect, green, solitary or in clusters of 1–3(5), axillary, and sessile. Flowers have 1 stamen, 1 style, and 3 stigmas. The calyx is minute, 3–5 times cleft, and the segments are concave, subequal, and unchanged in fruit. The fruit is a depressed globose utricle, indurate, finely costate, and 1–2 mm across. The seeds are horizontal, lenticular, rugulose, and black. Flowering time is March–June.

Taxonomic History and Distinguishing Characteristics

Aphanisma blitoides was described by Thomas Nuttall in 1849. It is a distinctive genus due to its dehiscent fruits, a calyx which is unchanged in fruit (vs. *Beta* which has an indurate calyx in age), and perfect flowers with a superior ovary, 3 style branches, and a single stamen. Its sprawling habit, clasping ovate to obovate leaves, and red foliage in age also contribute to its recognition.

Distribution

Aphanisma is a monotypic genus and is found in widely-scattered populations near the coast in California and Baja California. Its northern limit is Point Sal in Santa Barbara County, and it ranges south to the Vizcaino desert in Baja California. It is found on all of the California Channel Islands except San Miguel, as well as on 7 of the Baja California Islands (i.e., Los Coronados, Todos Santos, San Martin, Guadalupe, San Benito, Cedros, and Natividad).

Habitat

On San Nicolas Island, *Aphanisma* is usually found amongst dense clumps of *Opuntia* in the coastal scrub community, at elevations between 30 and 120 m. It also grows in protected swales and gullies, usually under other plants. Associated plants include *Achillea millefolium*, *Achnatherum diegoense*, *Apiastrum angustifolium*, *Artemisia nesiotica*, *Atriplex semibaccata*,

Avena fatua, *Bromus diandrus*, *B. hordeaceus*, *B. madritensis* subsp. *rubens*, *Calystegia macrostegia* subsp. *amplissima*, *Chenopodium murale*, *Coreopsis gigantea*, *Dichelostemma capitatum*, *Galium aparine*, *Hemizonia clementina*, *Isocoma menziesii*, *Lomatium insulare*, *Lotus argophyllus* var. *ornithopus*, *Lycium californicum*, *Malacothrix foliosa* subsp. *polycephala*, *M. saxatilis* var. *implicata*, *Mesembryanthemum nodiflorum*, *Nassella lepida*, *Opuntia littoralis*, *O. oricola*, *Parietaria hespera*, *Pterostegia drymarioides*, and *Sonchus oleraceus*.

Status

On San Nicolas Island, *Aphanisma* was not reported between 1901 and 1992. Only 4 populations, each with fewer than 10 plants, have been found on San Nicolas Island since 1992 (Fig. 5).

On the Northern Channel Islands, occurrences of the taxon have been very sporadic, both geographically and temporally. *Aphanisma* has not been seen on Santa Rosa Island since 1932. It was not collected on Santa Cruz Island between 1939 and 1995, and is currently known from only 1 population on that island. On Anacapa Island, *Aphanisma* has only been seen once (in 1992).

On 2 of the Southern Channel Islands, *Aphanisma* is more common. Widespread, but small, populations occur on Santa Barbara and San Clemente islands. On Santa Catalina Island, *Aphanisma* is known from a single location.

On the southern California mainland, populations of *Aphanisma* have suffered steep declines in recent years (Skinner and Pavlik 1994).

Management Suggestions

The 4 known populations of *Aphanisma* on San Nicolas Island should be protected from disturbance. We recommend that this species be resurveyed each year for the next 5 years to determine annual variation in population sizes and locations.

Annotated Bibliography

Abrams, L. 1917. Flora of Los Angeles and vicinity. Stanford Bookstore, Stanford University, California. 432 p.

Reported from San Pedro on the California mainland and from Santa Catalina Island.

Abrams, L. 1944. Illustrated flora of the Pacific States. Volume II. Polygonaceae to Krameriaceae. Stanford University Press, Stanford, California. 635 p.

Reported from bluffs along the mainland seacoast between Los Angeles County and northern Baja California and from the adjacent islands.

Beauchamp, R. M. 1986. A flora of San Diego County, California. Sweetwater River Press, National City, California. 241 p.

Reported as frequent in coastal alkaline areas below elevations of 25 m. Specific localities listed were San Onofre, San Dieguito Creek, La Jolla, Silver Strand, Imperial Beach, and Carrizo Creek. Flowering times were listed as April–May.

Brandegee, T. S. 1900. Voyage of the *Wahlberg*. Zoe 5:19–28.

Reported from Guadalupe, San Benito, and Natividad islands.

Davidson, A., and G. L. Moxley. 1923. Flora of southern California. Times-Mirror Press, Los Angeles, California. 452 p.

Reported as "not infrequent" on coastal bluffs from San Pedro to Redondo, at Santa Barbara, and along the coast of San Diego County on the California mainland.

Dunkle, M. B. 1950. Plant ecology of the Channel Islands of California. Allan Hancock Pacific Expeditions 13(3):247–386.

Reported from Santa Barbara Island, where it was listed as occasional on eastern bluffs and northern canyon exposures, especially in shallow caves. The author identified *Aphanisma* as one of the taxa mostly restricted to north exposures in the canyons, along with *Gilia gilioides* [*G. nevinii*], *Nemophila racemosa* [*Pholistoma r.*], and *Polypodium californicum kaulfusii*. *Aphanisma* was also listed for the 4 Northern Channel Islands, (Santa Catalina, San Clemente, and Guadalupe islands), as well as from the adjacent mainland coast. The author stated that the taxon was probably a relict, endemic to areas of southern California maritime climate.

Eastwood, A. 1898. Studies in the herbarium and the field. II. Notes on the plants of San Nicolas Island. Proceedings of the California Academy of Sciences, Series 3, Botany 1:89–120, 140.

Reported for the California mainland at San Pedro and also from San Nicolas and San Clemente islands. On San Nicolas Island, it reportedly grew "only near the foot of *Leptosyne gigantea* [*Coreopsis gigantea*]."

Eastwood, A. 1929. Studies in the flora of Lower California and adjacent islands. Proceedings of the California Academy of Sciences, Series 4, 18(14):393–484.

Reported for Guadalupe and Cedros islands and for the California mainland at San Diego (the type locality).

Eastwood, A. 1941. The islands of southern California and a list of the recorded plants II. Leaflets of Western Botany 3(3):54–78.

Reported for Santa Rosa, Santa Cruz, Santa Barbara, and San Clemente islands.

Foreman, R. E. 1967. Observations on the flora and ecology of San Nicolas Island. U.S. Naval Radiological Defense Laboratory, San Francisco, California. Report USNRDL-TR-67-8. 79 p.

Aphanisma blitoides was specifically excluded from this checklist for San Nicolas Island, as the author was unable to locate a voucher specimen to substantiate earlier reports for the island.

Greene, E. L. 1885. Botany of the Coronados Islands. West American Scientist 1(10):69–71.

This taxon was reported for the Coronados Islands.

Hale, G. O. 1941. A survey of the vegetation of Cedros Island, Mexico. Unpublished M.A. thesis, University of California at Los Angeles. 96 p.

Reported for Cedros Island, where a single specimen was found "on cobbles of a spit near Morro Redondo."

Hoffmann, R. 1932. Notes on the flora of the Channel Islands off Santa Barbara, California. Bulletin of the Southern California Academy of Sciences 31(2):46–60.

Reported as frequent on "mesas above the sea" on the west end of Santa Cruz Island and on the south side of Santa Rosa Island.

Jepson, W. L. 1909–1943. A flora of California. Associated Students Store, University of California at Berkeley, California. 3 volumes. 1,726 p.

Reported for Del Mar, San Diego, and Carrizo Creek on the California mainland, as well as for Santa Barbara Island.

Jepson, W. L. 1925. A manual of the flowering plants of California. Associated Students Store, University of California at Berkeley. 1,238 p.

Reported for Del Mar, San Diego, and Carrizo Creek on the California mainland, as well as for Santa Barbara Island.

Junak, S. A., and J. M. Vanderwier. 1990. An annotated checklist of the vascular plants of San Nicolas Island, California. P. 121–145 in Proceedings of the Fifth Biennial Mugu Lagoon/ San Nicolas Island Ecological Research Symposium. Naval Air Station, Point Mugu, California.

Reported as rare on San Nicolas Island, with the last known collection made "among cacti" by B. Trask in 1901.

Junak, S., R. Philbrick, and C. Drost. 1993. A revised flora of Santa Barbara Island. P. 54–112 in M. Daily, editor. Santa Barbara Island. Occasional Paper No. 6. Santa Cruz Island Foundation, Santa Barbara, California.

Reported for Santa Barbara Island, on south and west-facing slopes in the southern and eastern portions of the island, especially in canyons.

Junak, S. A., and R. Philbrick. 1994. The vascular plants of Todos Santos Island, Baja California, Mexico. P. 407–428 in W. L. Halvorson and G. J. Maender, editors. The Fourth California Islands Symposium: Update on the Status of Resources. Santa Barbara Museum of Natural History, Santa Barbara, California.

This taxon was reported as scarce on Todos Santos Island.

Junak, S. A., and R. Philbrick. 1994. The flowering plants of San Martin Island, Baja California, Mexico. P. 429–447 in W. L. Halvorson and G. J. Maender, editors. The Fourth California Islands Symposium: Update on the Status of Resources. Santa Barbara Museum of Natural History, Santa Barbara, California.

This taxon was reported for San Martin Island, where it was common in widely scattered locations throughout.

Junak, S., T. Ayers, R. Scott, D. Wilken, and D. Young. 1995. A flora of Santa Cruz Island. Santa Barbara Botanic Garden and California Native Plant Society, Santa Barbara and Sacramento, California. 397 p.

Reported as rare on Santa Cruz Island, where it was known from only 4 collections made between 1930 and 1939. Habitat was listed as rocky slopes, sea bluffs, and stream banks in the Coastal Sage Scrub community, usually in association with *Opuntia* clumps. The authors also listed this species for all of the California Channel Islands except San Miguel (i.e., Santa Rosa, Santa Cruz, Anacapa, Santa Barbara, San Nicolas, Santa Catalina, and San Clemente) and for all of the Baja California Islands except San Geronimo (i.e., Los Coronados, Todos Santos, San Martin, Guadalupe, San Benito, Cedros, and Natividad). Distribution on the California mainland was listed as between Santa Barbara County and northern Baja California. Flowering times were listed as March–June.

Lyon, W. S. 1886. The flora of our southwestern archipelago. II. Botanical Gazette 11:330–336.

This taxon was reported from San Clemente Island.

Millspaugh, C. F., and L. W. Nuttall. 1923. Flora of Santa Catalina Island, California. Field Museum of Natural History, Publication No. 212, Botanical Series, 5:1–413.

Reported from Santa Catalina Island, in "dry situations near the sea." The authors cited a specimen collected by Blanche Trask "on old Indian mounds at Little Harbor." Flowering times were listed as May–August.

Moran, R. 1996. The flora of Guadalupe Island, Mexico. Memoirs of the California Academy of Sciences No. 19. 190 p.

Reported from "coastal southern California to west central Baja California and off-lying islands, except San Miguel." For Guadalupe Island, it was listed as "fairly common on rocky slopes near the shore in the southern part of the island, from Juniper Canyon and West Anchorage to the south end, and on Islote Negro and Outer Islet." The author commented that "it seems remarkable that [Edward] Palmer did not find it at the south end in 1889, and I wonder if it could possibly be a late arrival." The author stated that *Aphanisma* was first reported for Guadalupe Island in 1900.

Munz, P. A. 1935. A manual of southern California botany. Claremont Colleges, Claremont, California. 642 p.

Reported from "low places on coast" between Corona del Mar and Baja California, from Carrizo Creek, and from Santa Barbara and San Clemente islands.

Munz, P. A. 1974. A flora of southern California. University of California Press, Berkeley. 1,086 p.

Reported from coastal bluffs in the coastal sage scrub and coastal strand communities, from Los Angeles County to Baja California, and from "most Channel Islands."

Munz, P. A., and D. D. Keck. 1963. A California flora. University of California Press, Berkeley. 1,681 p.

Reported on coastal bluffs in the coastal strand and coastal sage scrub plant communities, between Los Angeles County and northern Baja California. The authors also reported this taxon from Santa Barbara and San Clemente islands. Flowering times were listed as April–May.

Oberbauer, T. A. 1993. Floristic analysis of vegetation communities on Isla de Cedros, Baja California, Mexico. P. 115–131 in F. G. Hochberg, editor. Third California Island Symposium: Recent Advances in Research on the California Islands. Santa Barbara Museum of Natural History, Santa Barbara, California.

Reported from Cedros Island, on "cliff slopes north of the pines" near Punta Norte and on the south coast.

Philbrick, R. N. 1972. The plants of Santa Barbara Island, California. Madroño 21(5), part 2:329–393.

Reported for Santa Barbara Island, in scattered south and west-facing locations on the east side of the island.

Raven, P. H. 1963. A flora of San Clemente Island, California. Aliso 5(3):289–347.

Reported for San Clemente Island, where it was listed as "common in grassland around the shores at relatively low elevations."

Shreve, F. and, I. L. Wiggins. 1964. Vegetation and flora of the Sonoran Desert. 2 volumes. Stanford University Press, Stanford, California. 1,740 p.

Listed for saline soils, mostly along the coast, in the lower and upper Sonoran Zones. Reported for the islands of southern California, the California mainland from Orange County southward into Baja California, in the Colorado Desert at Carrizo Creek, and also near Punta Prieta, Baja Calfornia. Flowering times were listed as February–May.

Skinner, M. W., and B. M. Pavlik, editors. 1994. Inventory of rare and endangered vascular plants of California. Special Publication No. 1, 5th edition. California Native Plant Society, Sacramento, California. 336 p.

Reported for Santa Barbara, Ventura, Los Angeles, Orange, and San Diego counties on the California mainland, and from Baja California. Also listed for Santa Rosa, Santa Cruz, Anacapa, Santa Barbara, San Nicolas, Santa Catalina, and San Clemente islands. With respect to current status, the authors stated that this taxon was "in steep decline" on the mainland and "also declining" on the Channel Islands. They reported that it was known from only 3 occurrences on San Nicolas Island and that it was last seen on Santa Cruz and Santa Rosa Islands in 1932. The authors stated that this species was threatened by "urbanization, recreational development, foot traffic, and by feral herbivores on Santa Catalina, Santa Cruz, and Santa Rosa islands."

Smith, C. F. 1952. A flora of Santa Barbara. Santa Barbara Botanic Garden, Santa Barbara, California. 100 p.

Listed the nearest known localities as Santa Rosa and Santa Cruz islands.

Smith, C. F. 1976. A flora of the Santa Barbara region, California. Santa Barbara Museum of Natural History, Santa Barbara, California. 331 p.

Reported on California mainland on "bank below parking area at Point Sal," on "bluff west of Ventura," and south to Baja California. Also reported "in cactus on cliffs about west end of Santa Cruz Island (Christy Ranch), and on south side of Santa Rosa Island (mouth of Tranquillon Canyon)." Flowering times were listed as March–May.

Smith, J. P. Jr., and K. Berg, editors. 1988. Inventory of rare and endangered vascular plants of California. Special Publication No. 1, 4th edition. California Native Plant Society, Sacramento, California. 168 p.

Reported for Santa Barbara, Los Angeles (where listed as possibly extirpated), Orange, and San Diego counties on the California mainland, and from Baja California. Also listed for Santa Rosa, Santa Cruz, Anacapa, Santa Barbara, Santa Catalina, and San Clemente islands. Habitat was listed as Coastal Bluff Scrub and Coastal Scrub. The authors stated that more information on location, rarity, and endangerment was needed.

Thorne, R. F. 1967. A flora of Santa Catalina Island, California. Aliso 6(3):1–77.

Reported for Santa Catalina Island, where it was described as a "rare annual found only on rocky bluffs at the east side of Catalina Harbor" at an elevation of 46 m. Also listed for the California mainland between coastal Los Angeles County and Baja California, and for San Miguel, Santa Barbara, San Clemente, and Guadalupe islands.

Thorne, R. F. 1969. A supplement to the floras of Santa Catalina and San Clemente islands, Los Angeles Country, California. Aliso 7(1):73–83.

Listed as an associate of *Calandrinia maritima* on San Clemente Island, along with *Euphorbia misera*, *Lycium californicum*, *Bergerocactus emoryi*, *Festuca octoflora* var. *hirtella*, *Hordeum pusillum*, *Eschscholzia ramosa*, *Oligomeris linifolia*, *Phacelia lyonii*, *Cryptantha maritima* var. *maritima*, and *Microseris heterocarpa*.

Trask, B. 1904. Flora of San Clemente Island. II. Bulletin of the Southern California Academy of Sciences 3:90–95.

Reported for San Clemente Island "along sea-cliff edges," in habitats similar to those where the author had observed this species on Santa Catalina Island.

Vasey, G., and J. N. Rose. 1890. List of plants collected by Dr. Edward Palmer in Lower California in 1889. Contributions from the U.S. National Herbarium 1(1):9–28.

Reported from San Quintin on the Baja California peninsula and from Guadalupe, Cedros, and San Benito islands.

Wallace, G. D. 1985. Vascular plants of the Channel Islands of southern California and Guadalupe Island, Baja California. Natural History Museum of Los Angeles, Contributions in Science No. 365:1–136.

Reported for Santa Rosa, Santa Cruz, Anacapa, Santa Barbara, San Nicolas, Santa Catalina, San Clemente, and Guadalupe islands. Listed as unsubstantiated for San Miguel Island.

Wiggins, I. L. 1980. Flora of Baja California. Stanford University Press, Stanford, California. 1,025 p.

Reported from bluffs along the California mainland coast from Los Angeles County to El Desierto de Vizcaino in Baja California, and from the "offshore islands to Isla Guadalupe." Flowering times were listed as April–May.

Wilken, D. 1993. *Aphanisma*. P. 501 in J. C. Hickman, editor. The Jepson manual: higher plants of California. University of California Press, Berkeley.

Listed as rare in coastal shrubland, bluffs, sand at elevations below 100 m, between the southern end of the Central Coast and Baja California, as well as on the Channel Islands.

Figure 3. *Aphanisma blitoides*, showing sprawling habit, near campground on Santa Barbara Island, California (photo taken 12 April 1992).

Figure 4. *Aphanisma blitoides*, showing clasping leaves and inconspicuous flowers, in Cat Canyon on Santa Barbara Island, California (photo taken 3 March 1993).

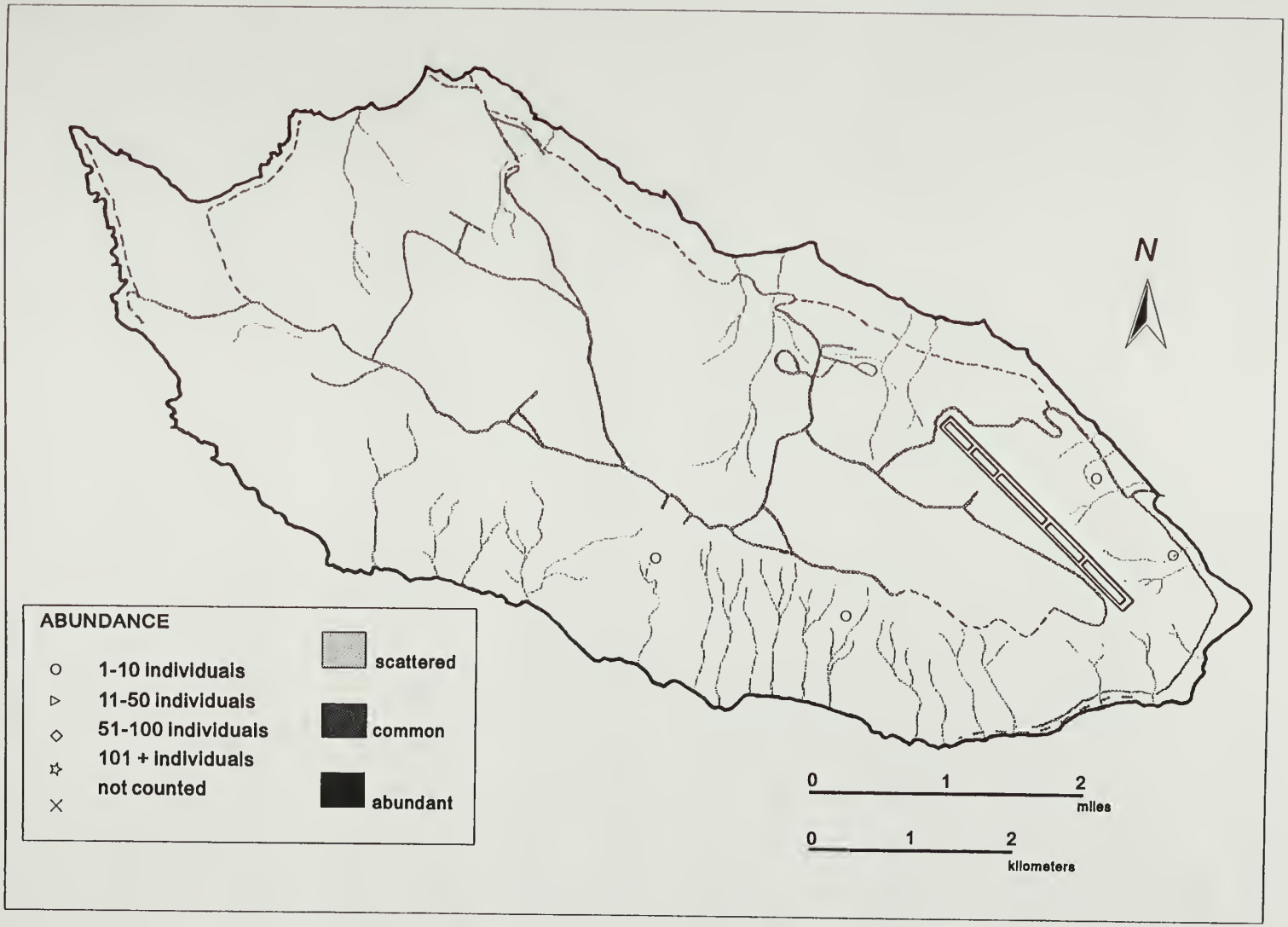

Figure 5. Distribution of *Aphanisma blitoides,* San Nicolas Island, California, 1992–1995.

Botanical Name: *Artemisia nesiotica* Raven

Common name: Island sagebrush

Family: Asteraceae

Listing Status

Federal: Not listed
State: Not listed
CNPS: Not listed (Skinner and Pavlik 1994)

Description

Artemisia nesiotica is a shrub, 6–15 dm high, with slender, wand-like stems from a brittle woody base (Fig. 6). The leaves are flat, canescent, 1–10 cm long, with blunt apices; they are pinnately divided into linear-filiform segments 1–3 mm wide. Inflorescences are narrow, with many discoid heads in long racemose panicles. Phyllaries are in several series, widely ovate with scarious margins. Ray florets number 10–15, while disk florets number 20–40. Achenes are resinous, 1–1.5 mm long. Pappus is a minute crown. Flowering time is July–October.

Taxonomic History and Distinguishing Characteristics

This taxon was first described as *Crossostephium insulare* by Rydberg in 1916. In his 1935 manual of southern California botany, Philip Munz published the name *A. californica* var. *insularis*. Peter Raven treated the taxon as *A. nesiotica* in his 1963 flora of San Clemente Island. A number of morphological characters distinguish *A. nesiotica* from *A. californica*. The leaves of *A. nesiotica* are flat or only slightly revolute, less lobed than those of *A. californica*, and 1–3 mm wide; leaves of *A. californica* are generally revolute, and usually less than 1 mm wide. *A. nesiotica* also has fuller heads, with up to 15 ray florets and 40 disk florets, as opposed to 6–10 and 15–30 respectively in *A. californica*.

Distribution

Over 300 species of *Artemisia* are found in the northern hemisphere and South America. At least 18 species, found in a variety of habitats, are native to California. *A. nesiotica* is endemic to the California Islands; it is restricted to San Nicolas, Santa Barbara, and San Clemente islands.

Habitat

On San Nicolas Island, *A. nesiotica* is scattered in gullies, swales, canyons, and on coastal flats in the northeastern and southern portions of the island (Figs. 7 and 8). It is found in the coastal scrub communities at elevations between 25 and 120 m and is often associated with *Opuntia* patches. Associated plants include *Achillea millefolium*, *Achnatherum diegoense*, *Apiastrum angustifolium*, *Atriplex semibaccata*, *Avena fatua*, *Baccharis pilularis*, *Bromus diandrus*, *B. hordeaceus*, *B. madritensis* subsp. *rubens*, *Calystegia macrostegia* subsp. *amplissima*, *Coreopsis gigantea*, *Dichelostemma capitatum*, *Dudleya virens* subsp. *insularis*, *Hemizonia clementina*, *Isocoma menziesii*, *Lomatium insulare*, *Lotus argophyllus* var. *ornithopus*, *Lycium californicum*, *Malacothrix foliosa* subsp. *polycephala*, *M. saxatilis* var. *implicata*, *Mesembryanthemum nodiflorum*, *Opuntia littoralis*, *O. oricola*, and *Sonchus oleraceus*.

Status

At least 12 healthy populations, each with 6 to 50 individuals, were found on San Nicolas Island during this survey (Fig. 9). Several age classes were seen and seedlings were plentiful in some areas.

Small, widely-scattered populations of this species also occur on Santa Barbara and San Clemente islands and appear to be healthy.

Management Suggestions

Although this species was found to be widespread during this survey, the habitat of all populations of this insular endemic should be protected from excessive erosion and disturbance. Of special concern are several populations which occur near Beach Road on the northeastern coastal terraces; these should not be disturbed. All known populations should be resurveyed at least every 5 years.

Annotated Bibliography

Abrams, L., and R. Ferris. 1960. Illustrated flora of the Pacific States. Volume IV. Bignoniaceae to Compositae. Stanford University Press, Stanford University, California. 732 p.

Reported *Artemisia californica* var. *insularis* from San Nicolas and San Clemente islands. The authors discussed morphological differences between the varieties of *A. californica.*

Davidson, A., and G. L. Moxley. 1923. Flora of southern California. Times-Mirror Press, Los Angeles, California. 452 p.

Reported *Crossostephium insulare* from San Nicolas and San Clemente islands.

Dunkle, M. B. 1950. Plant ecology of the Channel Islands of California. Allan Hancock Pacific Expeditions 13(3):247–386.

Reported *A. californica* var. *insularis* for Santa Barbara, San Nicolas, and San Clemente islands. On Santa Barbara Island, it was reported as common and widespread on the eastern terraces, southern exposures of canyons, and southern bluffs.

Eastwood, A. 1941. The islands of southern California and a list of the recorded plants II. Leaflets of Western Botany 3(3):54–78.

Reported *A. californica* var. *insularis* from San Miguel, Santa Rosa, Santa Cruz, Anacapa, Santa Barbara, San Nicolas, Santa Catalina, and San Clemente islands.

Foreman, R. E. 1967. Observations on the flora and ecology of San Nicolas Island. U.S. Naval Radiological Defense Laboratory, San Francisco, California. Report USNRDL-TR-67-8. 79 p.

Reported *A. nesiotica* for Santa Barbara, San Nicolas, and San Clemente islands. On San Nicolas Island, this taxon was reported as infrequent, occurring as "scattered clones along the northeast and south escarpments" of the island.

Junak, S. A., and J. M. Vanderwier. 1990. An annotated checklist of the vascular plants of San Nicolas Island, California. P. 121–145 in Proceedings of the Fifth Biennial Mugu Lagoon/ San Nicolas Island Ecological Research Symposium. Naval Air Station, Point Mugu, California.

Reported *A. nesiotica* for Santa Barbara, San Nicolas, and San Clemente islands. On San Nicolas Island, this taxon was reported as scattered along the northeastern and southern escarpments, on bluffs above Celery Canyon, and in the canyon northeast of the living compound.

Junak, S., R. Philbrick, and C. Drost. 1993. A revised flora of Santa Barbara Island. P. 54–112 in M. Daily, editor. Santa Barbara Island. Occasional Paper No. 6. Santa Cruz Island Foundation, Santa Barbara, California.

Listed *A. nesiotica* as endemic to Santa Barbara, San Nicolas, and San Clemente islands. On Santa Barbara Island, this taxon was reported from terrace slopes and canyons in the eastern portion of the island.

Munz, P. A. 1968. Supplement to a California flora. University of California Press, Berkeley, California. 224 p.

Reported *A. nesiotica* for Santa Barbara, San Nicolas, and San Clemente islands. The author also listed distinguishing characteristics of *Artemisia nesiotica* and *A. californica.*

Munz, P. A. 1974. A flora of southern California. University of California Press, Berkeley, California. 1,086 p.

Artemisia nesiotica was reported from foggy hillsides in the coastal sage scrub community on Santa Barbara, San Nicolas, and San Clemente islands. Flowering time was listed as April–September.

Philbrick, R. N. 1972. The plants of Santa Barbara Island, California. Madroño 21(5), part 2:329–393.

Artemisia californica var. *insularis* was listed as endemic to Santa Barbara, San Nicolas, and San Clemente Islands. On Santa Barbara Island, it was reported to be scattered in the eastern portion of the island.

Raven, P. H. 1963. A flora of San Clemente Island, California. Aliso 5(3):289–347.

Reported as endemic to Santa Barbara, San Nicolas, and San Clemente islands. On San Clemente Island, the author reported its distribution as scattered in open grassland at the north end and along the west shore to the south end. Raven proposed the name *A. nesiotica* for this taxon, stating: "Having had the opportunity of studying this [taxon] and *A. californica* on San Clemente Island, I have been forced to the conclusion that they are

entirely distinct and should be treated as separate species. There is no intergradation between them, and they are ecologically very different, *A. californica* occurring on the drier, hotter slopes, *A. nesiotica* on the lower, foggy hillsides. The leaves of *A. nesiotica* are not or slightly revolute, less lobed than those of *A. californica*, and 1–3 mm wide; in addition, as pointed out by Ward (in Abrams & Ferris, Ill. Fl. Pac. St. 4: 409. 1960.), *A. nesiotica* also has fuller heads, with up to 15 ray florets and to 40 disc florets, as opposed to 6–10 and 15–30 in *A. californica*."

Raven, P. H. 1967. The floristics of the California Islands. P. 57–67 in R. Philbrick, editor. Proceedings of the Symposium on the Biology of the California Islands. Santa Barbara Botanic Garden, Santa Barbara, California.

Reported *A. nesiotica* as endemic to Santa Barbara, San Nicolas, and San Clemente islands.

Rydberg, P.A. 1914. *Crossostephium*. North American Flora 34(1):243–244.

Type description of *Crossostephium insulare*, from a specimen collected by Blanche Trask on San Clemente Island in June 1903. Reported for San Nicolas and San Clemente islands.

Shultz, L. 1993. *Artemisia*. P. 202–205 in J. C. Hickman, editor. 1993. The Jepson Manual: Higher Plants of California. University of California Press, Berkeley, California. 1,400 p.

Reported *A. nesiotica* for the Southern Channel Islands, on rocky slopes at elevations below 100 m. The author commented that this taxon is "distinct from *A. californica*."

Wallace, G. D. 1985. Vascular plants of the Channel Islands of southern California and Guadalupe Island, Baja California. Natural History Museum of Los Angeles County, Contributions in Science No. 365:1–136.

Reported *A. nesiotica* as endemic to Santa Barbara, San Nicolas, and San Clemente islands.

WESTEC Services, Inc. 1978. Survey of archaeological and biological resources of San Nicolas Island. Unpublished report prepared for Pacific Missile Test Center. 51 p., maps and appendices.

Reported *A. nesiotica* for San Nicolas Island.

Figure 6. *Artemisia nesiotica*, near campground on Santa Barbara Island, California (photo taken 11 May 1982).

Figure 7. Population of *Artemisia nesiotica* (in foreground) growing with *Coreopsis gigantea*, on northeastern escarpment of San Nicolas Island, California (photo taken 24 March 1993).

Figure 8. Habitat of *Aphanisma blitoides* and *Artemisia nesiotica* (in shallow gullies in foreground), just east of "L" Canyon, northeastern side of San Nicolas Island, California (photo taken 13 June 1995).

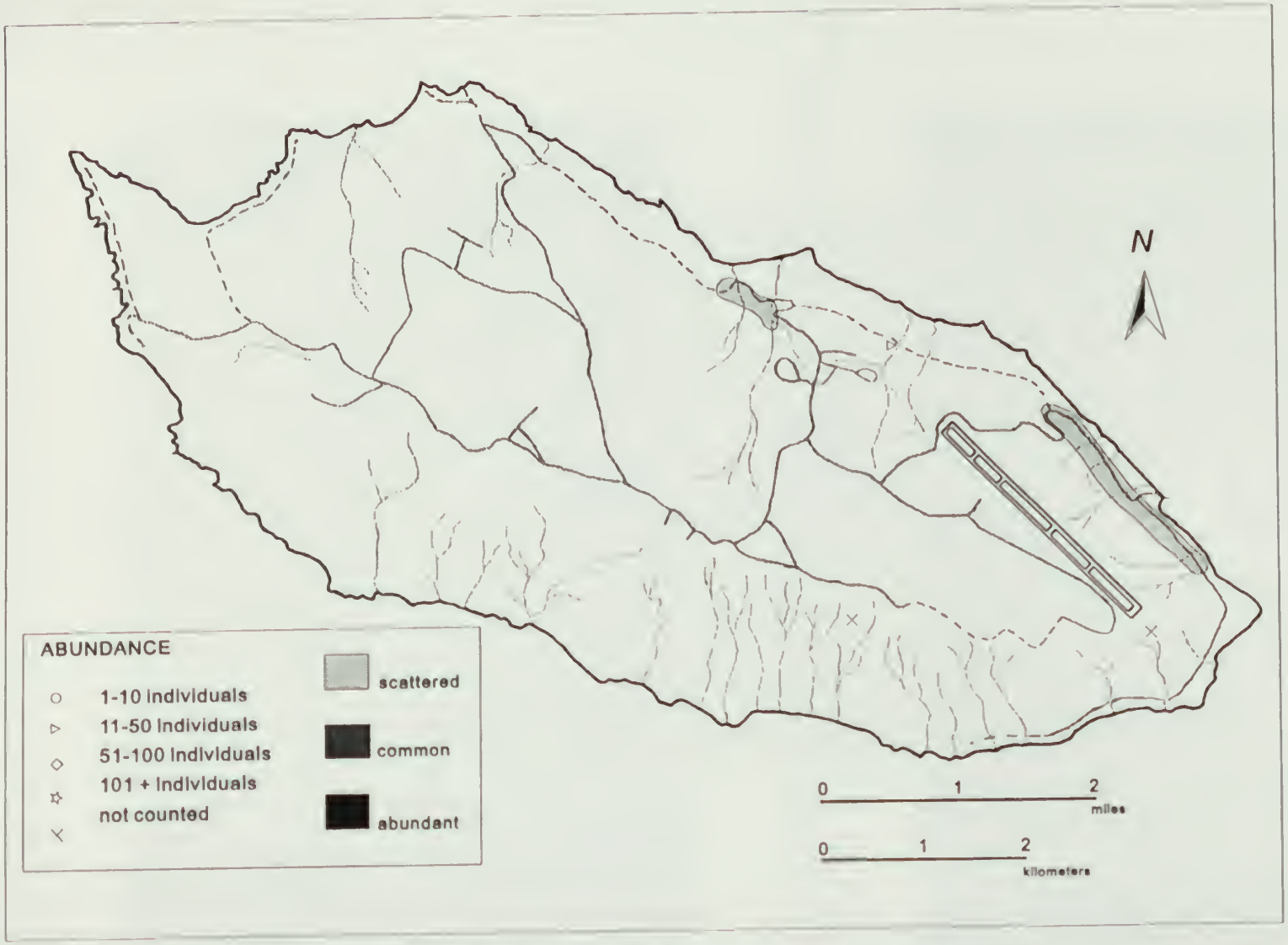

Figure 9. Distribution of *Artemisia nesiotica*, San Nicolas Island, California, 1992–1995.

Botanical name: *Atriplex pacifica* A. Nelson

Common name: South coast saltscale

Family: Chenopodiaceae

Listing status

Federal: C2
State: Not listed
CNPS: 1B (Skinner and Pavlik 1994)

Description

Atriplex pacifica is an annual herb that generally has prostrate to decumbent stems 1–5 dm long (Fig. 10). The branches are scaly, sometimes becoming more or less glabrous in age. Leaf blades are 4–18 mm long, elliptic to oblanceolate, gray to white scaly below, greenish above, with tapered bases. Leaves are numerous, sessile or the lower with petioles 6–14 mm long. Flowering time is March–October.

Taxonomic History and Distinguishing Characteristics

This taxon was first described as *Obione microcarpa* by George Bentham in 1844. David Dietrich published the name *A. microcarpa* in 1852 and Aven Nelson treated this taxon as *A. pacifica* in 1904. *Atriplex pacifica* can easily be confused with *A. coulteri*; it can only be reliably distinguished from that species when fruits are available. Fruiting bracts of *A. pacifica* are 1–1.5 mm long and have 3–5 teeth along the apical margins, while those of *A. coulteri* are 2–3 mm long and have deeply dentate margins.

Distribution

Atriplex is a genus of about 250 species which occur in temperate to subtropical areas worldwide. *Atriplex pacifica* occurs on the California mainland coast between Ventura County and northern Baja California. It has been found on all of the California Channel Islands except San Miguel and also occurs on the Baja California islands of Los Coronados, San Martin, Cedros, and Natividad.

Habitat

On San Nicolas Island, *A. pacifica* has been found on coastal flats in openings between shrubs, at elevations between 18 and 30 m. A population was also seen on an eroded east-facing canyon wall at an elevation of about 27 m. Known populations are restricted to the northeastern portion of the island and occur in *Coreopsis* scrub and grassland/scrub communities. Associated plants include *Amblyopappus pusillus*, *Atriplex semibaccata*, *Avena barbata*, *Bromus hordeaceus*, *Bromus madritensis* subsp. *rubens*, *Calystegia macrostegia* subsp. *amplissima*, *Coreopsis gigantea*, *Crassula connata*, *Daucus pusillus*, *Erodium moschatum*, *Hemizonia clementina*, *Isocoma menziesii*, *Lamarckia aurea*, *Lepidium oblongum*, *Lycium californicum*, *Malacothrix polycephala*, *Medicago polymorpha*, *Melilotus indicus*, *Mesembryanthemum nodiflorum*, *Plantago ovata*, *Senecio vulgaris*, *Spergularia macrotheca*, and *Trifolium palmeri*.

Status

During this survey, only 3 small populatioons of *A. pacifica* were found on San Nicolas Island (Fig. 11). Apparently, it was not collected on the island between the 1930s and 1993 and is extremely rare there.

This taxon appears to be rare throughout its range. On the Northern Channel Islands, *A. pacifica* is known from only a few locations on both Santa Rosa and Anacapa islands and from only 2 locations on Santa Cruz Island. On the Southern Channel Islands, it is known from only 2 locations on Santa Barbara Island and from a few localities on both Santa Catalina and San Clemente islands.

A. pacifica is also extremely rare on Los Coronados and San Martin islands, where it is known from a single collection on each island. On the California mainland, many known occurrences of this taxon have been extirpated, and its range has been greatly reduced by urbanization (Skinner & Pavlik 1994).

Management Suggestions

The 3 known populations of this taxon on San Nicolas Island should be protected from disturbance. Areas where the taxon currently occurs, as well as similar habitats nearby, should be resurveyed every year for the next 5 years to assess annual fluctuations in population size.

Annotated Bibliography

Abrams, L. 1944. Illustrated flora of the Pacific States. Volume II. Polygonaceae to Krameriaceae. Stanford University Press, Stanford, California. 635 p.

Reported *A. pacifica* from saline soils near the coast in the Sonoran Zones, on the California mainland from Los Angeles County to Baja California and on the adjacent islands. Flowering times were listed as March–October.

Brandegee, T. S. 1890. Flora of the Californian Islands. Zoe 1(5):145.

Reported *A. microcarpa* for Santa Cruz and San Clemente islands.

Dunkle, M. B. 1950. Plant ecology of the Channel Islands of California. Allan Hancock Pacific Expeditions 13(3):247–386.

Listed *A. pacifica* as a "constituent of the sea bluff communities" on Santa Rosa, Santa Catalina, Anacapa, Santa Barbara, San Nicolas, and San Clemente islands. The report for Santa Barbara Island on p. 293 was apparently a printer error; the author probably meant to list Santa Catalina Island since *A. pacifica* was not included in the annotated checklist for Santa Barbara Island provided on p. 326.

Eastwood, A. 1941. The islands of southern California and a list of the recorded plants II. Leaflets of Western Botany 3(3):54–78.

Reported *A. pacifica* for Santa Rosa, Santa Cruz, Anacapa, San Nicolas, Santa Catalina, and San Clemente islands.

Foreman, R. E. 1967. Observations on the flora and ecology of San Nicolas Island. U.S. Naval Radiological Defense Laboratory, San Francisco, California. Report USNRDL-TR-67-8. 79 p.

Atriplex pacifica was specifically excluded from this annotated checklist; the author did not find an herbarium specimen to document the taxon from San Nicolas Island.

Gentry, H. S. 1949. Land plants collected by the *Velero III*, Allan Hancock Pacific Expeditions 1937–1941. Allan Hancock Pacific Expeditions 13(2):7–245.

Reported *A. pacifica* from Cannery Bay on the east side of Cedros Island, where it was collected from a small population in sandy, rocky soils of an alluvial fan.

Hale, G. O. 1941. A survey of the vegetation of Cedros Island, Mexico. Unpublished M.A. thesis, University of California at Los Angeles, California. 96 p.

Reported *A pacifica* for Cedros Island, where it was found only at the south end of the island. This taxon was reportedly abundant "in the small playas on the mesa inland from the village, at an elevation of from 100–200 feet."

Hoffmann, R. 1932. Notes on the flora of the Channel Islands off Santa Barbara, California. Bulletin of the Southern California Academy of Sciences 31(2):46–60.

Reported *A. microcarpa* from " mesa above cliffs" on Anacapa Island.

Howell, J. T. 1942. A short list of plants from Cedros Island, Lower California. Leaflets of Western Botany 3(8):180–185.

Reported *A. pacifica* for Cedros Island, where it was "rather common on coastal bluff at South Bay."

Jepson, W. L. 1909–1943. A flora of California. Associated Students Store, University of California at Berkeley, California. 3 volumes. 1,726 p.

Treated here as *A. microcarpa*, this taxon was reported for San Pedro, San Diego, and Baja California on the mainland; also reported for Santa Cruz and San Clemente islands.

Jepson, W. L. 1925. A manual of the flowering plants of California. Associated Students Store, University of California at Berkeley, California. 1,238 p.

Treated here as *A. microcarpa*, this taxon was reported for San Pedro, San Diego, and Baja California on the mainland; also reported for Santa Cruz and San Clemente islands.

Junak, S., R. Philbrick, and C. Drost. 1993. A revised flora of Santa Barbara Island. P. 54–112 in M. Daily, editor. Santa Barbara Island. Occasional Paper No. 6. Santa Cruz Island Foundation, Santa Barbara, California.

Reported *A. pacifica* for Santa Barbara Island, where it was found in open sites on the eastern terrace and on the south side of Signal Peak. Several specimens, collected between 1961 and 1986, were cited.

Junak, S. A., and R. Philbrick. 1994. The flowering plants of San Martin Island, Baja California, Mexico. P. 429–447 in W. L. Halvorson and G. J. Maender, editors. The Fourth California Islands Symposium: Update on the Status of Resources. Santa Barbara Museum of Natural History, Santa Barbara, California.

Atriplex pacifica was reported for San Martin Island, where it was listed as rare on lava flats in the southern portion of the island. A single collection, made in 1970, was cited.

Junak, S., T. Ayers, R. Scott, D. Wilken, and D. Young. 1995. A flora of Santa Cruz Island. Santa Barbara Botanic Garden and California Native Plant Society, Santa Barbara and Sacramento, California. 397 p.

Reported *A. pacifica* for Santa Cruz Island, but distribution information for this taxon was inadvertantly carried over from the previous entry in this book (*A. leucophylla*). In the original manuscript, *A. pacifica* was reported as rare on rocky ridgetops and coastal flats, in the Coastal Scrub community at elevations between 15 and 65 m. *Atriplex pacifica* was known to the authors only from the vicinity of Coches Prietos and Valley anchorages. The authors listed this species for all of the California Channel Islands except San Miguel (i.e., Santa Rosa, Santa Cruz, Anacapa, Santa Barbara, San Nicolas, Santa Catalina, and San Clemente) and for the Baja California Islands of San Martin, Cedros, and Natividad. Distribution on the California mainland was listed as between Los Angeles County and northern Baja California. Flowering times were given as May–July.

Lyon, W. S. 1886. The flora of our southwestern archipelago. II. Botanical Gazette 11:330–336.

Treated here as *A. microcarpa*, this taxon was reported for San Clemente Island.

Millspaugh, C. F., and L. W. Nuttall. 1923. Flora of Santa Catalina Island, California. Field Museum of Natural History, Publication No. 212, Botanical Series, 5:1–413.

Reported *A. pacifica* from Santa Catalina Island, in "dry, open situations". The authors cited specimens collected in the vicinity of Avalon and from the summit of Black Jack [Peak] at an elevation of 610 m. Flowering times were listed as March–July.

Munz, P. A. 1974. A flora of southern California. University of California Press, Berkeley, California. 1,086 p.

Reported *A. pacifica* from sea bluffs in coastal sage scrub from Los Angeles County to Baja California. Also reported from Santa Rosa, Santa Catalina, and San Clemente islands.

Nelson, A. 1904. A decade of new plant names. Proceedings of the Biological Society of Washington 17:99–100.

The author published the name *Atriplex pacifica*.

Oberbauer, T. A. 1993. Floristic analysis of vegetation communities on Isla de Cedros, Baja California, Mexico. P. 115–131 in F.G. Hochberg, editor. Third California Island Symposium: Recent Advances in Research on the California Islands. Santa Barbara Museum of Natural History, Santa Barbara, California.

Reported *A. pacifica* for Cedros Island, where it occurs in scattered locations on the "northern end, west coast, and Cerro de Cedros Spring."

Shreve, F., and I. L. Wiggins. 1964. Vegetation and flora of the Sonoran Desert. 2 volumes. Stanford University Press, Stanford, California. 1,740 p.

Reported *A. pacifica* from sandy soil back of beaches and along roadsides and trails in the Upper and Lower Sonoran zones, near the coast from Los Angeles County south to Cedros Island.

Skinner, M. W., and B. M. Pavlik, editors. 1994. Inventory of rare and endangered vascular plants of California. Special Publication No. 1, 5th edition. California Native Plant Society, Sacramento, California. 336 p.

Reported *A. pacifica* for Ventura (where presumed extinct), Los Angeles, Orange (where presumed extinct), Riverside, and San Diego counties, and for Baja California. Also reported the taxon for Santa Rosa, Santa Cruz, Anacapa, San Nicolas, Santa Catalina, and San Clemente islands. The authors stated that many known occurrences of the taxon had been extirpated, that its range had been greatly reduced by urbanization, and that more information on its distribution was needed.

Smith, C. F. 1976. A flora of the Santa Barbara Region, California. Santa Barbara Museum of Natural History, Santa Barbara, California. 331 p.

Reported *A. pacifica* for Anacapa Island (on "border of cliff") and cited reports by other authors for Santa Rosa and Santa Cruz islands. The author stated that this species can be confused with *A. coulteri*.

Taylor, D., and D. H. Wilken. 1993. *Atriplex*. P. 501–505 in J. C. Hickman, editor. The Jepson manual: higher plants of California. University of California Press, Berkeley, California.

Reported *A. pacifica* as rare on bluffs and in shrubland at elevations below 100 m, along the coast of southern California to Baja California, and also from the California Channel Islands.

Vasey, G., and J. N. Rose. 1890. List of plants collected by Dr. Edward Palmer in Lower California in 1889. Contributions from the U.S. National Herbarium 1(1):9–28.

Reported *A. microcarpa* for Cedros Island.

Wallace, G. D. 1985. Vascular plants of the Channel Islands of southern California and Guadalupe Island, Baja California. Natural History Museum of Los Angeles County, Contributions in Science No. 365:1–136.

Reported *A. pacifica* for Santa Cruz, Anacapa, San Nicolas, Santa Catalina, and San Clemente islands.

Wiggins, I. L. 1980. Flora of Baja California. Stanford University Press, Stanford, California. 1,025 p.

Reported *A. pacifica* from sandy soil near the coast from Los Angeles County south to Cedros Island and "on some adjacent islands." Flowering times were reported as March–October.

Yates, L. G. 1890. Insular Floras. P. 179–188 in Ninth Annual Report of the State Mineralogist. California State Mining Bureau, Sacramento, California.

Reported *A. microcarpa* for Santa Cruz Island.

Figure 10. *Atriplex pacifica*, on West Anacapa Island, California. Its distinctive fruits are visible (with magnifying glass or hand lens) in the lower left portion of the photo.

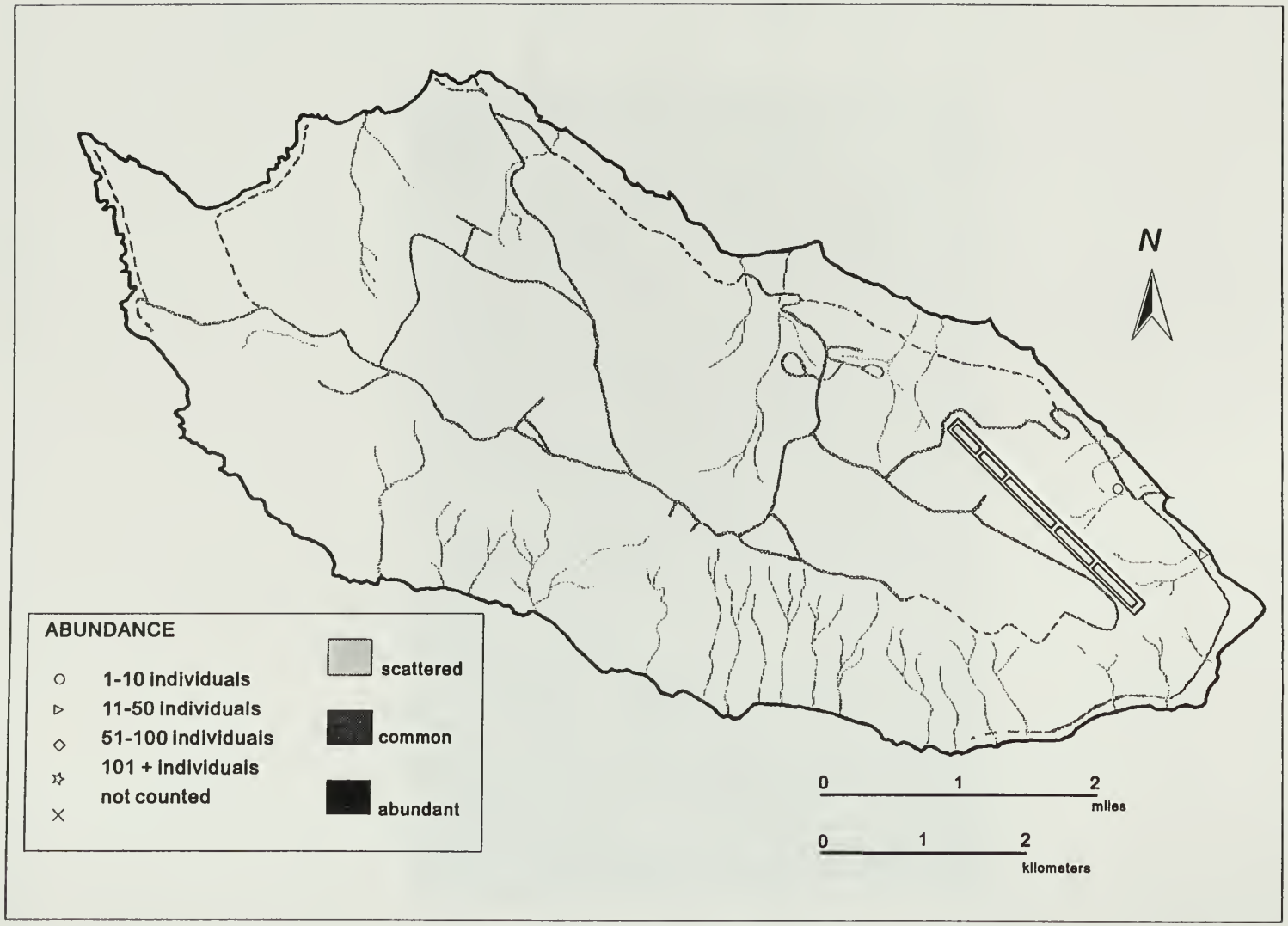

Figure 11. Distribution of *Atriplex pacifica,* San Nicolas Island, California, 1993–1995.

Botanical name: *Hordeum intercedens* Nevski

Common name: Vernal barley or little barley

Family: Poaceae

Listing status

Federal: Not listed
State: Not listed
CNPS: List 3 (Skinner and Pavlik 1994)

Description

Hordeum intercedens is an annual grass, 1.0–3.5 dm tall, with erect, flat blades (Fig. 12). Auricles are absent. The inflorescence is erect, 2–7 cm long, breaking apart in fruit, with the central and lateral spikelets often falling together. Spikelets are arranged in 2 opposite rows, 3 per node, with the central one fertile, sessile. The central spikelet has awn-like, subulate glumes that are slightly wider near the base and are 8–15 mm long; lemmas are 5–9 mm long, and awns are 6–12 mm long. The lateral spikelets are short-pedicellate, sterile or staminate, with awn-like glumes 12–18 mm long; lemmas are 2–6 mm long, with acute apices or with awns 0.5–1.5 mm long. Flowering times are March–May (June).

Taxonomic History and Distinguishing Characteristics

Hordeum intercedens was described by Sergei Nevski in 1941, from plants collected by LeRoy Abrams in San Diego in 1905. Until recently however, many botanists in the western United States have confused this taxon with *H. pusillum*, which does not occur in California (Bothmer et al. 1982). *Hordeum intercedens* can be distinguished from *H. pusillum* by its obtuse to acute (vs. aristulate to aristate) lateral spikelets, which are 1.7–4.4 mm (vs. 2.8–5.7 mm) long, and by its spreading glumes (vs. not spreading) in fruit. *Hordeum intercedens* also has stripes of hairs on the leaf sheaths, while those of *H. pusillum* are glabrous.

Distribution

The genus *Hordeum*, comprising about 40 species, is found in temperate portions of North America, Europe, and Asia. Ten taxa have been reported for California, including 4 taxa that have been introduced from Europe. *Hordeum intercedens* occurs in widely-scattered locations near the coast from the San Francisco Bay region to northwestern Baja California and on all 8 of the California Channel Islands.

Habitat

On San Nicolas Island, *H. intercedens* occurs primarily in the south-central and eastern portions of the mesa at elevations between 150 and 275 m (Fig. 13). Small, isolated populations have also been found on coastal flats at the extreme northeastern and extreme southeastern ends of the island, at elevations between 5 and 20 m. This grass occupies open habitats in the grassland community, occurring on clay flats and especially in low spots where surface water accumulates during the wet seasons. Isolated populations have also been found on eroded south-facing slopes. Associated species include *Amblyopappus pusillus*, *Atriplex semibaccata*, *Avena barbata*,

A. fatua, *Bromus diandrus*, *B. hordeaceus*, *B. madritensis* subsp. *rubens*, *Centaurea melitensis*, *Erodium cicutarium*, *E. moschatum*, *Frankenia salina*, *Hemizonia clementina*, *Hordeum murinum*, *Isocoma menziesii*, *Juncus bufonius*, *Lamarckia aurea*, *Lasthenia californica*, *Lolium perenne*, *Medicago polymorpha*, *Mesembryanthemum crystallinum*, *M. nodiflorum*, *Parapholis incurva*, *Plantago ovata*, *Sonchus oleraceus*, *Spergularia macrotheca*, and *Suaeda taxifolia*.

Status

On San Nicolas Island, *H. intercedens* was found during this survey to be widespread in the eastern half of the mesa (Fig. 14). On the other California Channel Islands, its abundance appears to be correlated with seasonal rainfall. It can be common in years with significant precipitation and rare during dry years. On the California mainland, most populations have been extirpated by development, and some of those remaining are threatened (Skinner & Pavlik 1994).

Management Suggestions

Observations made during this survey suggest that population sizes and locations are extremely variable from year to year. This species should be re-surveyed every year for the next 5 years to document this variability. Any grading or ground disturbance on the east end of the mesa should be done during the mid to late summer, after seeds of *H. intercedens* have been dispersed.

Annotated Bibliography

Abrams, L. 1917. Flora of Los Angeles and vicinity. Stanford Bookstore, Stanford University, California. 432 p.

Reported *H. pusillum* in low, heavy, usually saline, soil from San Diego on the California mainland and from Santa Catalina Island.

Barkworth, M. E. 1993. *Hordeum*. P. 1,264–1,266 in J. C. Hickman, editor. The Jepson manual: higher plants of California. University of California Press, Berkeley, California.

Reported *H. intercedens* from vernal pools, dry saline streambeds, and alkaline flats below elevations of 1,000 m in southwestern California and northwestern Baja California.

Baum, B. R., and L. G. Bailey. 1986. Taxonomy of the North and South American species of *Hordeum* section *Hordeastrum*. Canadian Journal of Botany 64:1,745–1,759.

This study, comparing micromorphological characters of the lodicule and epiblast in *H. euclaston*, *H. flexuosum*, *H. intercedens*, and *H. pusillum*, supported previous taxonomic treatments that recognized 4 distinct taxa.

Baum, B. R., and L. G. Bailey. 1988a. A taxonomic study of the annual *H. depressum* and related species. Canadian Journal of Botany 66:401–408.

This study clarified morphological differences between the tetraploid *H. depressum* and its diploid allies *H. intercedens* and *H. pusillum*. The authors suggested that *H. intercedens* may be one of the parents of the allopolyploid *H. depressum*.

Baum, B. R., and L. G. Bailey. 1988b. A taxonomic investigation of *Hordeum arizonicum* (Poaceae: Triticeae) with reference to related species. Canadian Journal of Botany 66:1,848–1,855.

In this numerical study of 6 species in the genus *Hordeum*, the authors found that *H. intercedens* is closely related to, and may be one of the diploid parents of, the hexaploid *H. arizonicum*.

Beauchamp, R. M. 1986. A flora of San Diego County, California. Sweetwater River Press, National City, California. 241 p.

Reported *H. intercedens* as uncommon in alkaline spots in cismontane San Diego County at elevations below 1,000 m. Specific localities listed were Witch Creek and San Diego. Flowering times were given as April–May.

Bothmer, R. von, N. Jacobsen, R. B. Jorgensen, and E. Nicora. 1982. Revision of the *Hordeum pusillum* group. Nordic Journal of Botany 2:307–321.

Reported *H. intercedens* from Santa Rosa, San Nicolas, Santa Catalina, and San Clemente islands, and on the mainland from the San Francisco Bay area (where it was known from a single collection) south to Baja California. The authors reported that the 2 populations examined during their study were diploid (2n=14) and discussed the variation in morphological characteristics in the species. Habitats described for the taxon included flooded, often saline, riverbeds, and alkaline flats in shrublands.

Bothmer, R. von, M. Kotimaki, and Z. Persson. 1985. Genome relationships between 8 diploid *Hordeum* species. Hereditas 103:1–16.

In this study involving reciprocal artifical crosses between 8 species in *Hordeum* section *Anisolepis*, only a few combinations failed and most hybrid combinations were morphologically well-developed. F_1 hybrids between *Hordeum intercedens* and *H. pusillum* produced seeds which germinated to an F_2 generation, indicating a close relationship between those 2 species.

Bothmer, R. von, J. Flink, and T. Landstrom. 1986. Meiosis in interspecific *Hordeum* hybrids. I. Diploid combinations. Canadian Journal of Genetics and Cytology 28:525–535.

In this study of meiotic pairing behavior in the genus *Hordeum*, the North American diploid species *H. intercedens* and *H. pusillum* and 10 South American taxa constituted a homogeneous group with respect to genomic structure, which differed somewhat from that found in other Asiatic and North American species.

Bothmer, R. von, N. Jacobsen, C. Baden, R. B. Jorgensen, and I. Linde-Laursen. 1991. An ecogeographical study of the genus *Hordeum*. Systematic and ecogeographic studies on crop genepools No. 7. International Board for Plant Genetic Resources, Rome, Italy. 127 p.

Reported *H. intercedens* as endemic to southwestern California, "adjacent Santa Barbara islands," and northwestern Baja California. Its habitat was described as "along rivers, sometimes saline and often flooded areas such as alkaline vernal pools in shrublands, and hillsides, at low altitude." The authors stated that "the species is still rather common in Baja California and at most sites in the Santa Barbara Islands in undisturbed habitats, but on mainland California it has declined and is now found in only very few sites." The authors found considerable morphological variation in the species, reporting that some populations (especially from central California) were almost glabrous, and that a few populations had shortly aristulate lateral spikelets (though most had obtuse to acute spikelets).

Davidson, A., and G. L. Moxley. 1923. Flora of southern California. Times-Mirror Press, Los Angeles, California. 452 p.

Reported *H. pusillum* in subsaline soils near the coast from Los Angeles to San Diego on the California mainland.

Eastwood, A. 1941. The islands of southern California and a list of the recorded plants. II. Leaflets of Western Botany 3(3):54–78.

Reported *H. pusillum* for San Miguel, Santa Catalina, and San Clemente islands.

Gould, F. W., and R. Moran. 1981. The grasses of Baja California, Mexico. Memoir No. 12. San Diego Society of Natural History, San Diego, California. 140 p.

Reported *H. pusillum* from North America, and from Baja California Norte, where it occurred in ditches and in and around vernal pools in the northwestern portion of the state (at Tijuana, Valle de Palmas, Rosarito, El Descanso, Colonia Guerrero, Erendira, and San Quintin) at elevations below 300 m, and on a salt flat northwest of Punta Blanca at an elevation of 5 m.

Jorgensen, R. B. 1986. Relationships in the barley genus (*Hordeum*): an electrophoretic examination of proteins. Hereditas 104:273–291.

Analysis of electrophoretic studies of 6 enzyme systems and crossing studies in the genus *Hordeum* indicated that the diploid species *H. intercedens* and *H. pusillum* were more closely related to the South American diploid species than to the other North American diploids. Evolutionary centers and possible migration pathways were discussed by the author.

Junak, S. A., and J. M. Vanderwier. 1990. An annotated checklist of the vascular plants of San Nicolas Island, California. P. 121–145 in Proceedings of the Fifth Biennial Mugu Lagoon/ San Nicolas Island Ecological Research Symposium. Naval Air Station, Point Mugu, California.

Reported *H. intercedens* as rare in small depressions at the eastern and southeastern end of the mesa on San Nicolas Island. The authors reported that this taxon has been confused with *H. pusillum*, which is not found in California. They also stated that many southern California mainland populations of *H. intercedens* have been extirpated, making island populations extremely important for continued survival of this rare grass.

Junak, S., R. Philbrick, and C. Drost. 1993. A revised flora of Santa Barbara Island. P. 54–112 in M. Daily, editor. Santa Barbara Island. Occasional Paper No. 6. Santa Cruz Island Foundation, Santa Barbara, California.

Reported *H. intercedens* for Santa Barbara Island, in disturbed sites and on grassy flats of the terrace near the eastern canyons.

Junak, S., T. Ayers, R. Scott, D. Wilken, and D. Young. 1995. A flora of Santa Cruz Island. Santa Barbara Botanic Garden and California Native Plant Society, Santa Barbara and Sacramento, California. 397 p.

Reported *H. intercedens* as occasional on Santa Cruz Island, where it was found on coastal bluffs, on coastal flats, in moist depressions, and on stabilized sand dunes at elevations between 10 and 455 m. It occurred in coastal scrub, grassland, riparian, and southern beach and dune communities, on the north side of the island on the West End Flats, between Pelican Bay and Prisoners' Harbor, and between China Harbor and Little Scorpion Canyon. It was also found in the island's Central Valley (in Canada Cebada) and on the south side of the island between West Point and the Black Point peninsula, and on the Sierra Blanca ridge. The taxon was also reported for all of the California Channel Islands, and on the mainland from the San Francisco Bay region to northwestern Baja California. Flowering time was listed as April.

Millspaugh, C. F., and L. W. Nuttall. 1923. Flora of Santa Catalina Island, California. Field Museum of Natural History, Publication No. 212, Botanical Series, 5:1–413.

Reported *H. pusillum* from Santa Catalina Island, in "open places under saline influence." Specific localities listed were Avalon and "along the upper road to Pebble Beach."

Munz, P. A. 1935. A manual of southern California botany. Claremont Colleges, Claremont, California. 642 p.

Reported *H. pusillum* as occasional in open, somewhat alkaline, places at San Diego on the California mainland and on San Miguel, Santa Catalina, and San Clemente islands.

Munz, P. A. 1974. A flora of southern California. University of California Press, Berkeley, California. 1,086 p.

Reported *H. pusillum* from more or less alkaline places below elevations of 1,525 m, ranging from cismontane southern California to Washington, the Atlantic Coast, and Argentina. The taxon was also reported for Santa Cruz, Santa Catalina, and San Clemente islands. Flowering times were listed as April–May.

Munz, P. A., and D. D. Keck. 1963. A California flora. University of California Press, Berkeley, California. 1,681 p.

Reported *H. pusillum* from more or less alkaline places below elevations of 1,525 m, ranging from cismontane southern California to Washington, the Atlantic Coast, and Argentina. Flowering times were listed as April–May.

Philbrick, R. N. 1972. The plants of Santa Barbara Island, California. Madroño 21(5), part 2:329–393.

Reported *H. pusillum* for Santa Barbara Island, where it was "primarily restricted to the terrace slopes near the eastern canyons."

Raven, P. H. 1963. A flora of San Clemente Island, California. Aliso 5(3):289–347.

Reported *H. pusillum* as common in grassland on San Clemente Island, "at least in [the] central and northern parts of the island."

Skinner, M. W., and B. M. Pavlik, editors. 1994. Inventory of rare and endangered vascular plants of California. Special Publication No. 1, 5th edition. California Native Plant Society, Sacramento, California. 336 p.

Reported *H. intercedens* from central and southern California and Baja California, as well as from Santa Rosa, Santa Cruz, Anacapa, Santa Barbara, San Nicolas, Santa Catalina, and San Clemente islands. Habitats listed for this taxon included valley and foothill grassland (in saline flats and depressions) and vernal pools. The authors stated that location and rarity information was needed for San Mateo, Monterey, and Los Angeles counties on the mainland, and for Santa Rosa, Santa Catalina, and San Clemente islands. They reported that most mainland occurrences had been extirpated by development and that other populations were threatened. They also stated that this taxon had been previously confused with *H. pusillum*. Flowering times were listed as March–June.

Smith, C. F. 1976. A flora of the Santa Barbara region, California. Santa Barbara Museum of Natural History, Santa Barbara, California. 331 p.

Reported *H. pusillum* from several fields and vernal meadow areas from Santa Barbara to Goleta, citing collections made between 1952 and 1969. Also reported the taxon from Santa Cruz and Anacapa islands and "possibly" Santa Rosa Island. Flowering times were listed as March–June.

Thorne, R. F. 1967. A flora of Santa Catalina Island, California. Aliso 6(3):1–77.

Reported *H. pusillum* as rare on Santa Catalina Island, on dry, open slopes at elevations between 30 and 120 m. The author cited 3 historic collections made in the 1920s and 1930s: in Middle Ranch Canyon below Eagle's Nest, at the Isthmus, and in "dried pools of the soapstone quarries" above Parson's Landing.

Wallace, G. D. 1985. Vascular plants of the Channel Islands of southern California and Guadalupe Island, Baja California. Natural History Museum of Los Angeles County, Contributions in Science No. 365:1–136.

Hordeum pusillum was reported for San Miguel, Santa Cruz, Anacapa, Santa Barbara, Santa Catalina, and San Clemente islands.

Wiggins, I. L. 1980. Flora of Baja California. Stanford University Press, Stanford, California. 1,025 p.

Hordeum pusillum was reported from North and South America and from northern Baja California, where it was found on alkaline flats and in the beds of vernal pools. Flowering times were listed as March–May.

Figure 12. *Hordeum intercedens*, on northeastern coastal flats, San Nicolas Island, California (photo taken 24 March 1993).

Figure 13. Habitat of *Hordeum intercedens*, on north side of airfield runways, San Nicolas Island, California (photo taken May 1993).

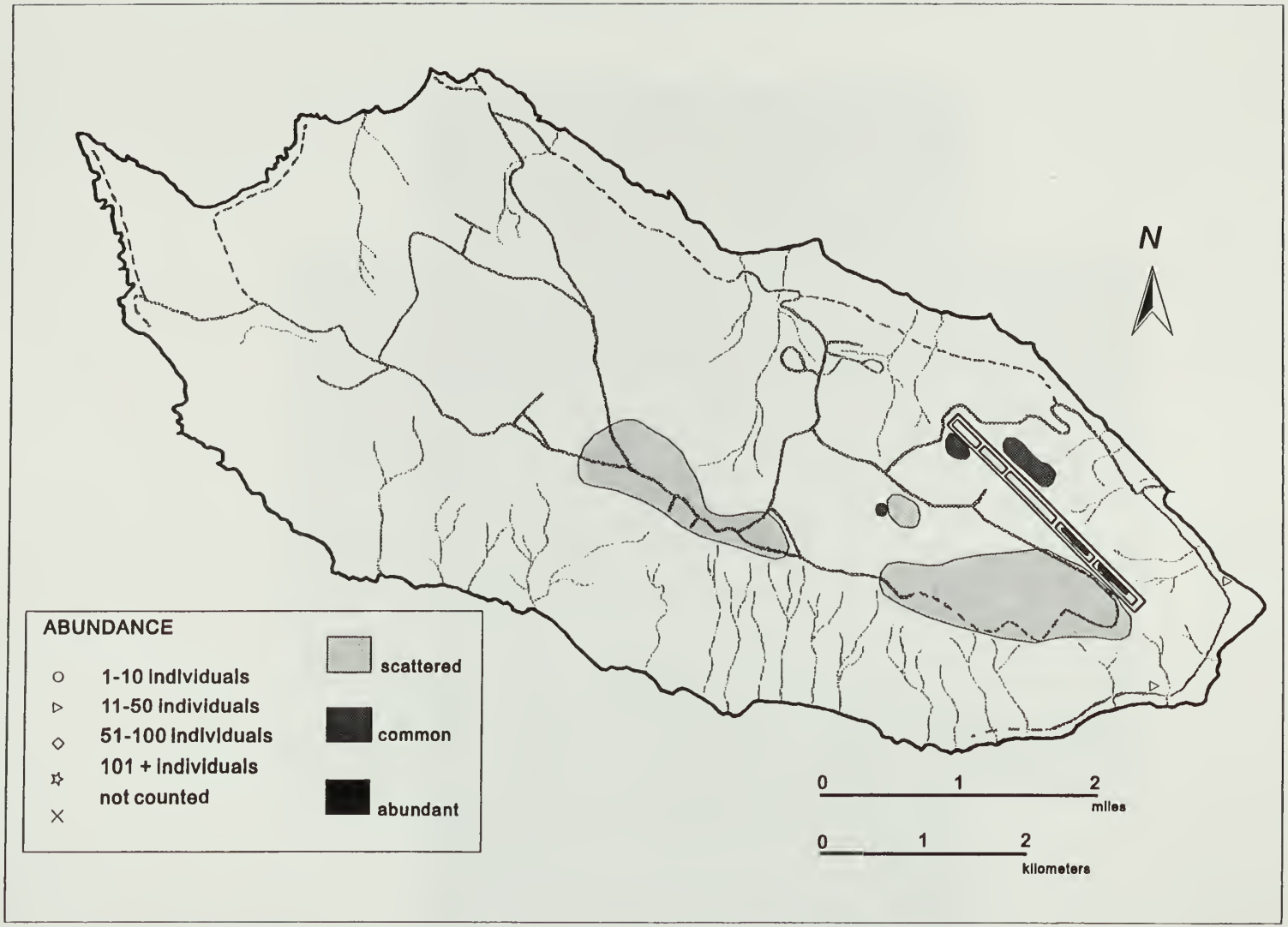

Figure 14. Distribution of *Hordeum intercedens*, San Nicolas Island, California, 1993.

Botanical name: *Lepidium oblongum* var. *insulare* C. Hitchc.

Common name: Peppergrass, lentejilla

Family: Brassicaceae

Listing status

Federal: Not listed
State: Not listed
CNPS: Not listed

Description

Lepidium oblongum var. *insulare* is a much-branched annual, 0.5–2 dm tall, with prostrate to ascending branches that are villose-hirsute (Fig. 15). Leaves are laciniate to pinnatifid or (the basal ones) bipinnatifid; basal leaves are about 3 cm long. Racemes are many, 6–9 cm long; pedicels are somewhat flattened, scarcely wing-margined; sepals are slightly over 1 mm long, not long-persistent; petals are 0 or minute. Silicles are mostly glabrous with pubescent margins, flat, rotund to obovate in outline, 2–2.5 mm long, indistinctly reticulate, narrow-winged; apices are rounded with a small v-shaped sinus; the persistent stigma is subsessile; seeds are about 1 mm long. Flowering time is March–April (May).

Taxonomic History and Distinguishing Characteristics

Lepidium oblongum var. *insulare* was named by C. Leo Hitchcock in 1945 from plants collected on Guadalupe Island, Baja California. Variety *insulare* differs from its closest relative in silique shape and size. *Lepidium oblongum* var. *oblongum* has elliptic siliques that are 2.5–3.2 mm long. Pubescence on the lower (abaxial) surface of the pedicels is extremely variable and cannot be used reliably to distinguish the 2 varieties of *Lepidium oblongum*, as several keys would suggest.

Distribution

The genus *Lepidium*, comprising about 175 species, is found in temperate regions worldwide. About 36 taxa in the genus occur in California and 8 taxa are found on the California Channel Islands. *Lepidium oblongum* var. *insulare* is found in coastal areas from the Central Coast of California to Baja California. It occurs on all of the California Channel Islands except Santa Barbara (i.e., San Miguel, Santa Rosa, Santa Cruz, Anacapa, San Nicolas, Santa Catalina, and San Clemente) and on all of the Baja California Islands except San Geronimo (i.e., Los Coronados, Todos Santos, San Martin, Guadalupe, San Benito, Cedros, and Natividad). The closely-related *L. o.* var. *oblongum* occurs on the mainland, ranging east to Arkansas and Kansas and south through much of Mexico to Guatemala.

Habitat

On San Nicolas Island, *Lepidium oblongum* occurs primarily on coastal flats and escarpments of the north and south sides of the island, between elevations of 15 and 230 m (mostly between 15 and 50 m). It is found on sandy alluvial flats, gully bottoms, eroded slopes, disturbed areas, and open ridgetops (Fig. 16). Many populations are found on flats with heavy clay soils covered with a dense lichen crust. Small populations have also been found on the mesa, in sandy openings

amongst shrubs between elevations of 120 and 195 m. *Lepidium oblongum* occurs mostly in *Isocoma* and *Coreopsis* scrub communities, where associated species include *Abronia umbellata*, *Achillea millefolium*, *Amblyopappus pusillus*, *Ambrosia chamissonis*, *Astragalus traskiae*, *Atriplex californica, A. semibaccata*, *Avena barbata*, *Bromus hordeaceus*, *B. madritensis* subsp. *rubens*, *Calystegia macrostegia* subsp. *amplissima*, *Claytonia perfoliata*, *Coreopsis gigantea*, *Crassula connata*, *Cryptantha maritima* var. *maritima*, *Daucus pusillus*, *Eriogonum grande* var. *timorum*, *Erodium cicutarium*, *E. moschatum*, *Hordeum murinum*, *Isocoma menziesii*, *Lamarckia aurea*, *Lasthenia californica*, *Lomatium insulare*, *Lotus argophyllus* var. *ornithopus*, *Lupinus albifrons*, *Malacothrix polycephala*, *Medicago polymorpha*, *Melilotus indicus*, *Mesembryanthemum crystallinum*, *M. nodiflorum*, *Parapholis incurva*, *Plantago ovata*, *Pterostegia drymarioides*, *Salsola tragus*, *Senecio vulgaris*, *Sonchus oleraceus*, *Spergularia macrotheca*, *Suaeda taxifolia*, *Vulpia myuros*, and *V. octoflora*.

Status

This taxon is widespread on San Nicolas Island. About 30 small, healthy populations were found on the island during this survey (Fig. 17).

Lepidium oblongum var. *insulare* is widespread on most of the other islands off southern California and the west coast of Baja California. However, its range on the California and Baja California mainland has not been well studied to date. More information is needed about the status of its habitats on the mainland.

Management Suggestions

Because population densities and locations of this annual taxon may vary from year to year, it is recommended that the eastern portion of the mesa be re-surveyed each year for at least the next 5 years.

Annotated Bibliography

Foreman, R. 1967. Observations on the flora and ecology of San Nicolas Island. U.S. Naval Radiological Defense Laboratory, San Francisco, California. Report USNRDL-TR-67-8. 79 p.

Listed here as *L. oblongum*, this taxon was reported for San Nicolas Island. The author cited 2 voucher specimens, which were collected in 1897 and in 1932.

Hitchcock, C. L. 1945. The Mexican, Central American, and West Indian Lepidia. Madroño 8:118–143.

The type description of this taxon, which was reported from Del Mar on the California mainland, Sonora and Baja California in Mexico, and from the islands of Santa Cruz, Guadalupe, San Benito, Cedros, and Natividad. The author stated that "most material from the mainland of California and Lower California has larger silicles than do the insular plants, and is otherwise somewhat intermediate in character with the typical variety."

Howell, J. T. 1942. A list of vascular plants from Guadalupe Island, Lower California. Leaflets of Western Botany 3:145–168.

Reported this taxon from Guadalupe Island, citing collections made in the pine grove, on the slope of the pine ridge, and in the middle of the island.

Junak, S. A., and J. M. Vanderwier. 1990. An annotated checklist of the vascular plants of San Nicolas Island, California. P. 121–145 in Proceedings of the Fifth Biennial Mugu Lagoon/ San Nicolas Island Ecological Research Symposium, Naval Air Station, Point Mugu, California.

This taxon was reported as rare on San Nicolas Island, where it was found on the mesa south of the living compound and in the southeastern portion of the island.

Junak, S. A., and R. Philbrick. 1994. The vascular plants of Todos Santos Island, Baja California, Mexico. P. 407–428 in W. L. Halvorson and G. J. Maender, editors. The Fourth California Islands Symposium: Update on the Status of Resources. Santa Barbara Museum of Natural History, Santa Barbara, California.

Reported as rare on South Todos Santos Island, where this taxon was known from only 2 collections.

Junak, S. A., and R. Philbrick. 1994. The flowering plants of San Martin Island, Baja California, Mexico. P. 429–447 in W. L. Halvorson and G. J. Maender, editors. The Fourth California Islands Symposium: Update on the Status of Resources. Santa Barbara Museum of Natural History, Santa Barbara, California.

This taxon was reported for San Martin Island, where it was scarce on lava in the southeastern portion of the island.

Junak, S., T. Ayers, R. Scott, D. Wilken, and D. Young. 1995. A flora of Santa Cruz Island. Santa Barbara Botanic Garden and California Native Plant Society, Santa Barbara and Sacramento, California. 397 p.

The authors reported this taxon from all of the California Channel Islands except Santa Barbara, and from all of the Baja California islands except San Geronimo (i.e., Los Coronados, Todos Santos, San Martin, Guadalupe, Cedros, San Benito, and Natividad islands). It was reported as occasional on Santa Cruz Island, where it occurred in sandy sites as well as on rocky south-facing slopes, open ridgetops, and coastal bluffs at elevations from 1.5–340 m, in chaparral, coastal scrub, and grassland communities. It was known on Santa Cruz Island from coastal areas on the west and southwest end between the vicinity of Forney's Cove and Willows Canyon and from the Sierra Blanca ridge.

Moran, R. 1996. The flora of Guadalupe Island, Mexico. Memoirs of the California Academy of Sciences No. 19. 190 p.

This taxon was listed for San Miguel, Santa Cruz, Anacapa, San Nicolas, Santa Catalina, San Clemente, Todos Santos, Guadalupe, Cedros, San Benito, and Natividad islands. On Guadalupe Island, it was reported as "widespread, from the pine ridge to the south end and in good seasons fairly common."

Oberbauer, T. A. 1993. Floristic analysis of vegetation communities on Isla de Cedros, Baja California, Mexico. P. 115–131 in F. G. Hochberg, editor. Third California Island Symposium: Recent Advances in Research on the California Islands. Santa Barbara Museum of Natural History, Santa Barbara, California.

Reported for Cedros Island, where it occurred in "scattered locations the length of the island."

Rollins, R. C. 1993. *Lepidium.* P. 426–430 in J. C. Hickman, editor. The Jepson manual: higher plants of California. University of California Press, Berkeley, California.

Reported from bluffs, low hills, and slopes below elevations of 200 m between central California and Baja California, as well as from the California Channel Islands.

Rollins, R. C. 1993. The Cruciferae of continental North America. Stanford University Press, Stanford, California. 976 p.

Reported from "sea bluffs, grassy slopes, roadsides, among rocks, arroyos, near fields, plains, and low hills" from the California Channel Islands to Baja California. Flowering times were listed as October–May.

Smith, C. F. 1976. A flora of the Santa Barbara region, California. Santa Barbara Museum of Natural History, Santa Barbara, California. 331 p.

Reported for all 4 Northern Channel Islands (i.e., San Miguel, Santa Rosa, Santa Cruz, and Anacapa islands). Flowering times were listed as March–June.

Wallace, G. D. 1985. Vascular plants of the Channel Islands of southern California and Guadalupe Island, Baja California. Natural History Museum of Los Angeles County, Contributions in Science No. 365:1–136.

Lepidium oblongum was reported for San Miguel, Santa Cruz, Anacapa, San Nicolas, Santa Catalina, San Clemente, and Guadalupe islands.

WESTEC Services, Inc. 1978. Survey of archaeological and biological resources of San Nicolas Island. Unpublished report prepared for Pacific Missile Test Center. 51 p., maps and appendices.

Lepidium oblongum was reported for San Nicolas Island.

Wiggins, I. L. 1980. Flora of Baja California. Stanford University Press, Stanford, California. 1,025 p.

Lepidium oblongum was reported from sandy and gravelly soil along washes and arroyos, from central California to the California Channel Islands, and from the northern Sierra Juarez and Isla Guadalupe in Baja California. Flowering times were listed as February–May.

Figure 15. *Lepidium oblongum* var. *insulare*, showing mature silicles, northeast end of San Nicolas Island, California (photo taken 24 March 1993).

Figure 16. Habitat of *Lepidium oblongum* var. *insulare*, above west end of Daytona Beach, southeast side of San Nicolas Island, California (photo taken 11 March 1993).

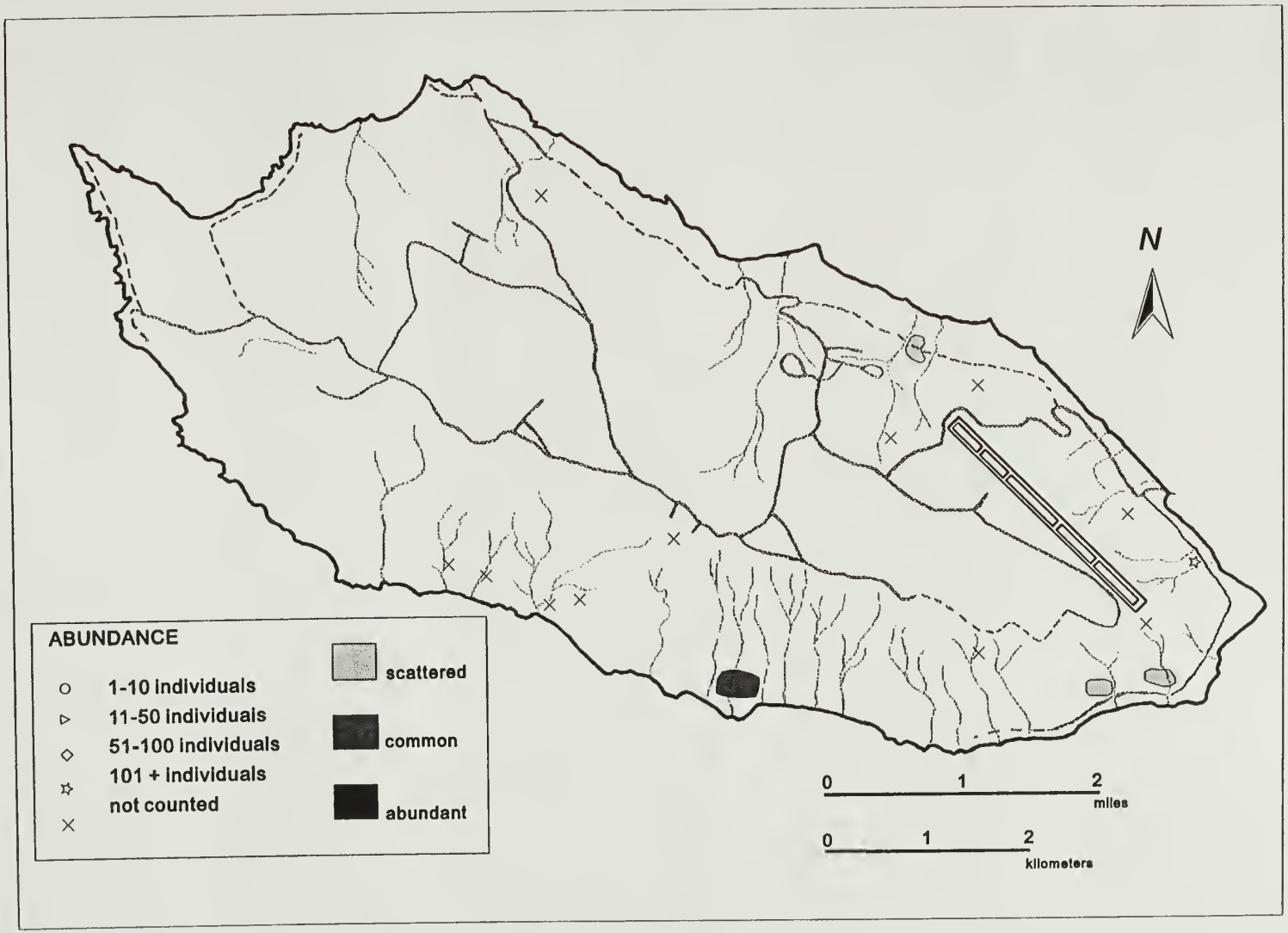

Figure 17. Distribution of *Lepidium oblongum,* San Nicolas Island, California, 1993.

Botanical Name: *Nassella cernua* (Stebbins & Love) Barkworth

Common name: Nodding needle grass

Family: Poaceae

Listing status

Federal: Not listed
State: Not listed
CNPS: Not listed

Description

Nassella cernua is a perennial grass, with densely tufted stems and numerous basal leaves that are usually glaucous. Culms are several and are 4–9 dm tall. Leaf blades are 0.5–2.5 mm wide and are flat to involute. The inflorescence is an open panicle, 1–8 dm long with branches 5–8 cm long; branches are distant, slender, spreading, flexuous, bearing 2 to several spikelets. Glumes are unequal, 9–20 mm long, 3-nerved, glabrous, with an acuminate apex. The lemma (excluding the awn) is 5–10 mm long, obscurely 5–7-nerved, with pilose veins, and awned at the apex. The awn is 50–110 mm long, twice bent at maturity, and is soft and flexuous beyond the second bend.

Taxonomic History and Distinguishing Characteristics

Stipa cernua was named in 1941 by G. Ledyard Stebbins and Robert Love and was treated as a variety of *S. pulchra* by Alan Beetle and Robert Tofsrud. *Nassella cernua* was named by Mary Barkworth in 1990. This taxon can be distinguished from the 2 other species in the genus *Nassella* that occur on San Nicolas Island on the basis of floral characteristics. *Nassella cernua* has longer glumes (13–20 mm vs. 5–12 mm long) and significantly longer lemmas (7–12 mm vs. 4–6.5 mm long) and awns (50–110 mm vs. 20–40 mm long) than *N. lepida*. *Nassella cernua* also has longer awns (50–110 mm vs. 45–90 mm long) than *N. pulchra*; the terminal segment of the awn is soft and flexuous in *N. cernua* (vs. stiff and rigid in *N. pulchra*).

Distribution

The genus *Nassella* comprises about 80 species found in North and South America. Three native and 1 nonnative species are found in California. *Nassella cernua* occurs in the Coast Ranges of California, the foothills of the Sierra Nevada, and in the northern portion of Baja California. It is also found on San Miguel, Santa Rosa, Santa Cruz, Anacapa, San Nicolas, Santa Catalina, and San Clemente islands.

Habitat

Nassella cernua is primarily found on the south side of San Nicolas Island; it is rare on the mesa and on the northeastern escarpment. *Nassella cernua* usually grows on exposed ridgetops, on south- or west-facing slopes, on canyon walls, or in open canyon bottoms at elevations between 24 and 240 m. It is most abundant at elevations between 30 and 150 m. Associated species include *Abronia umbellata*, *Achillea millefolium*, *Amblyopappus pusillus*, *Astragalus traskiae*, *Atriplex semibaccata*, *Avena barbata*, *Bromus madritensis* subsp. *rubens*, *Calystegia*

macrostegia subsp. *amplissima*, *Cryptantha maritima* var. *maritima*, *Daucus pusillus*, *Dichelostemma capitatum*, *Eriogonum grande* var. *timorum*, *Isocoma menziesii*, *Lomatium insulare*, *Lotus argophyllus* var. *ornithopus*, *Malacothrix saxatilis* var. *implicata*, *Mesembryanthemum nodiflorum*, *Oligomeris linifolia*, *Sonchus oleraceus*, and *Spergularia macrotheca*.

Status

On San Nicolas Island, *Nassella cernua* was found in small, widely-scattered populations nearly throughout the south escarpment of the island (Fig. 18). On the California mainland, it is widespread and fairly common in much of its range, but its habitat has been severely degraded and disturbed by cattle grazing and other agricultural activities in southern California.

Management Suggestions

Habitats of *N. cernua* on San Nicolas Island should be protected from excessive erosion and disturbance. Although populations seen during this survey appear to be healthy, known locations should be re-surveyed at least every 5 years to check the status of populations.

Annotated Bibliography

Barkworth, M. E., and J. Everett. 1988. Evolution in the Stipeae: identification and relationships of its monophyletic taxa. P. 251–264 in T. R. Soderstrom et al., editors. Grass Systematics and Evolution. Smithsonian Institution Press, Washington, D.C.

In this preliminary reinterpretation of the Stipeae, *S. cernua* was included in the genus *Nassella* but no formal nomenclatural proposal was made.

Barkworth, M. E. 1990. *Nassella* (Gramineae, Stipeae): revised interpretation and nomenclatural changes. Taxon 39(4):597–614.

Differences between the genera *Achnatherum*, *Nassella*, and *Stipa* were elucidated and the name *N. cernua* was published as a new combination.

Barkworth, M.E. 1993. *Nassella*. P. 1,274–1,276 in J.C. Hickman, editor. The Jepson Manual: Higher Plants of California. University of California Press, Berkeley.

Reported *N. cernua* for grassland, chaparral, and juniper woodland plant communities, at elevations below 1,400 m. Range in California was given as interior North Coast Ranges, eastern San Francisco Bay area, South Coast Ranges, Transverse Ranges, and Peninsular Ranges; the taxon was also reported for Baja California.

Beauchamp, R. M. 1986. A flora of San Diego County, California. Sweetwater River Press, National City, California. 241 p.

Reported *S. cernua* as infrequent on dry slopes below elevations of 1,500 m in San Diego County. Specific localities listed were San Miguel Mountain, San Diego, and Henshaw Dam. Flowering time was listed as April.

Crampton, B. 1961. The endemic grasses of the California Floral Province. Leaflets of Western Botany 9:154–158.

Reported *S. cernua* in oak woodland and chaparral of the foothills, from Tehama County and south in the inner Coast Range, to the coast at San Francisco and Monterey, and south to San Diego County. Also reported the species from the foothills of the Sierra Nevada, from Tehama County south to Kern County.

Dedecca, D. M. 1954. Studies on the Californian species of *Stipa*. Madroño 12:129–139.

Reported the results of morphological and anatomical investigations in the California species of the genus and provided a revised taxonomic key for the taxa.

Gould, F. W., and R. Moran. 1981. The grasses of Baja California, Mexico. Memoir No. 12. San Diego Society of Natural History, San Diego, California. 140 p.

Reported *S. cernua* from California and northern Baja California, on dry slopes to elevations of 1,500 m. Localities listed in Baja California included the coastal area south to El Rosario, the Sierra Juarez to 1,300 m (La Rumorosa and Portezuelo de Jamau), and the foothills of Sierra San Pedro Martir to elevations of 700 m.

Junak, S. A., and J. M. Vanderwier. 1990. An annotated checklist of the vascular plants of San Nicolas Island, California. P. 121–145 in Proceedings of the Fifth Biennial Mugu Lagoon/ San Nicolas Island Ecological Research Symposium. Naval Air Station, Point Mugu, California.

Reported *S. cernua* as scattered on San Nicolas Island, occurring in the eastern and central portions of mesa, and in canyons and slopes around perimeter of the island.

Junak, S., T. Ayers, R. Scott, D. Wilken, and D. Young. 1995. A flora of Santa Cruz Island. Santa Barbara Botanic Garden and California Native Plant Society, Santa Barbara and Sacramento, California. 397 p.

Reported *N. cernua* as common on Santa Cruz Island, where it is found at elevations between 6 and 535 m on coastal bluffs, rocky slopes, grassy hillsides, and exposed ridgetops in the coastal scrub and grassland plant communities. It was also reported for all of the other California Channel Islands except Santa Barbara (i.e., San Miguel, Santa Rosa, Anacapa, San Nicolas, Santa Catalina, and San Clemente islands) and for the mainland from the northern California Coast Ranges to Baja California.

Munz, P. A. 1974. A flora of southern California. University of California Press, Berkeley. 1,086 p.

Reported *S. cernua* from dry slopes below 1,360 m in coastal sage scrub and southern oak woodland plant communities. Range was given as northern California to San Diego County, and Santa Cruz and Santa Catalina Islands. Flowering times were given as April–May.

Raven, P. H. 1963. A flora of San Clemente Island, California. Aliso 5(3):289–347.

Reported *S. cernua* from dry grassland in the central and southern parts of San Clemente Island. Raven stated that "it is difficult to distinguish from *S. pulchra* on the island; one or the other occurred throughout [the island]." The author also listed *S. cernua* as 1 of 6 species found "on San Clemente Island and on the adjacent mainland, as well as on the northern islands, but have not yet been found on Santa Catalina Island, although they may actually be there or have been there at the time they reached San Clemente Island."

Raven, P. H., H. J. Thompson, and B. A. Prigge. 1966. Flora of the Santa Monica Mountains, California. 2nd edition. Special Publication No. 2, Southern California Botanists. University of California, Los Angeles. 181 p.

Reported *Stipa cernua* as scattered in the coastal sage scrub and chaparral plant communities in the western half of the Santa Monica Mountains, at elevations below 600 m.

Smith, C. F. 1976. A flora of the Santa Barbara region, California. Santa Barbara Museum of Natural History, Santa Barbara, California. 331 p.

Reported *S. cernua* as scattered on dry open slopes of grassland, woodland, and chaparral plant communities in the Santa Barbara region. Smith stated that it occurs in the coastal area but is apparently more common inland, to the potreros in the Sierra Madre Mountains and the Cuyama Valley. Also reported for Santa Cruz Island. Flowering times were listed as April–July.

Stebbins G. L., and R. M. Love. An undescribed species of *Stipa* from California. Madroño 6(3):137–141.

Type description of *S. cernua*, which is reported for California, from Tehama County south to San Diego County, east to the Sierra Nevada foothills, along the coast from Monterey southward, and extending up to elevations of about 1,360 m in southern California.

Thorne, R. F. 1967. A flora of Santa Catalina Island, California. Aliso 6(3):1–77.

Reported *Stipa cernua* as rare on Santa Catalina Island, on dry, eroded, clayey, or grassy slopes at elevations between 420 and 450 m. Thorne stated: "This grass may be more frequent than thus indicated for I was unable to distinguish it in the field from *Stipa pulchra*. In fact, I have considerable doubt that it is specifically distinct from *S. pulchra*."

Wallace, G. D. 1985. Vascular plants of the Channel Islands of southern California and Guadalupe Island, Baja California. Natural History Museum of Los Angeles County, Contributions in Science No. 365:1–136.

Reported *S. cernua* for Santa Rosa, Santa Cruz, Anacapa, San Nicolas, Santa Catalina, and San Clemente islands.

Wiggins, I. L. 1980. Flora of Baja California. Stanford University Press, Stanford, California. 1,025 p.

Reported *Stipa cernua* from Tehama County to coastal foothills of San Diego County, and "probably in northern Baja California." Flowering times were listed as April–May.

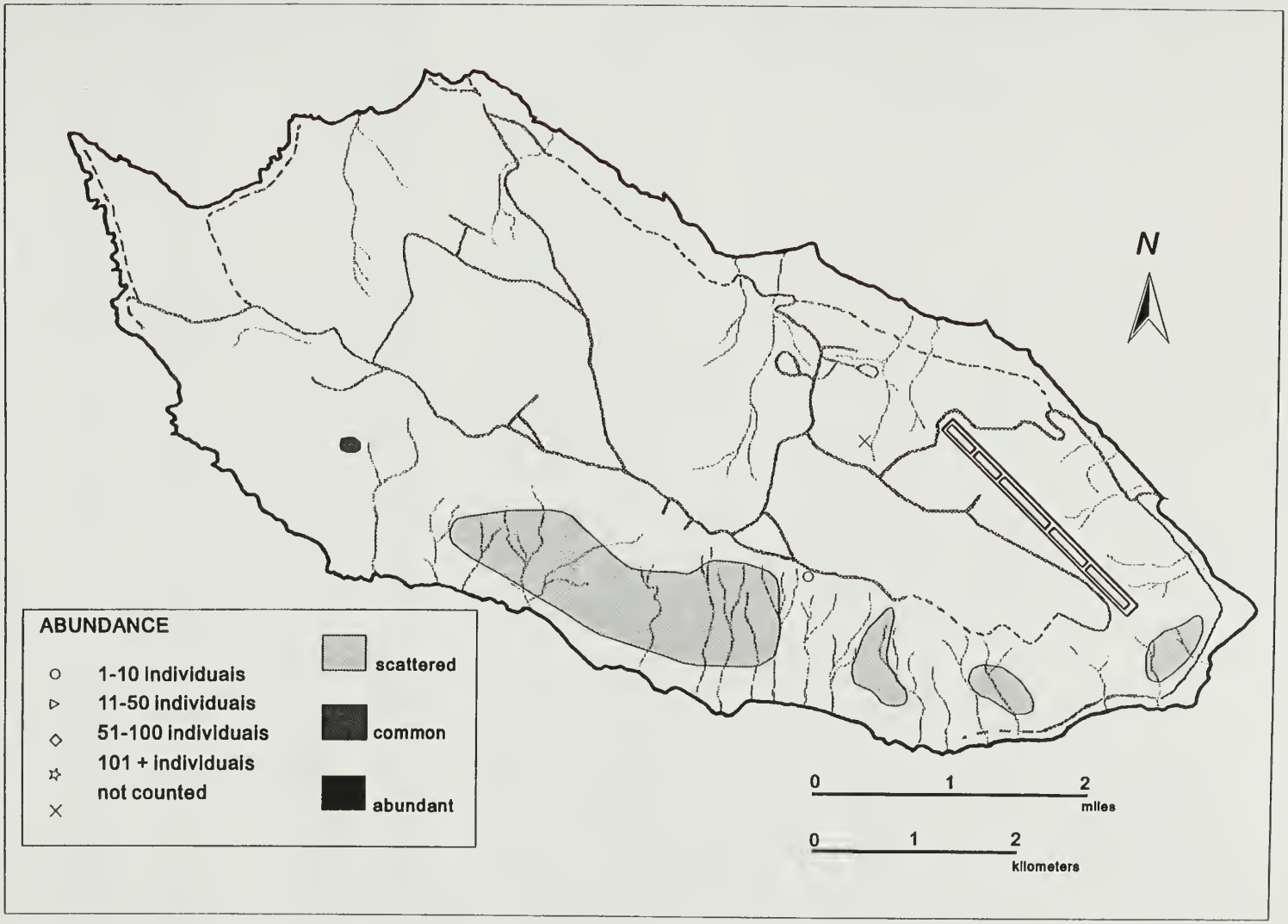

Figure 18. Distribution of *Nassella cernua,* San Nicolas Island, California, 1993.

Botanical name: *Nassella lepida* (Hitchc.) Barkworth

Common name: Foothill needle grass or small-flowered needle grass

Family: Poaceae

Listing Status

Federal: Not listed
State: Not listed
CNPS: Not listed

Description

Nassella lepida is a perennial grass, with densely tufted stems and numerous basal leaves (Fig. 19). Culms are several and are 6–10 dm tall. Leaf blades are 1.5–4 mm wide and are usually flat. The inflorescence is an open panicle, 1–5 dm long with branches 5–8 cm long; branches are single, in pairs, or in clusters, ascending to more or less spreading. Glumes are unequal, 5–12 mm long, 3-nerved, glabrous, with an acuminate apex. The lemma (excluding the awn) is 4–6.5 mm long, obscurely 5–7-nerved, usually villosulous, sometimes sparsely pubescent between the veins, and awned at the apex. The awn is 20–40 mm long, twice bent at maturity, and is slender and flexuous beyond the second bend.

Taxonomic History and Distinguishing Characteristics

Stipa lepida was first described by Albert Hitchcock in 1915 and *N. lepida* was named by Mary Barkworth in 1990. This taxon can be readily distinguished from the 2 other members of the genus *Nassella* which occur on San Nicolas Island because its flowers are much smaller. *Nassella lepida* has shorter glumes (5–12 mm vs. 9–20 mm long) and significantly shorter lemmas (4–6.5 mm vs. 7–12 mm long) and awns (20–40 mm vs. 45–110 mm long) than *N. cernua* and *N. pulchra.*

Distribution

The genus *Nassella* comprises about 80 species found in North and South America. Three native and 1 nonnative species are found in California. *Nassella lepida* is widespread in the western portion of California (west of the Sierra Nevada) and also occurs on all of the California Channel Islands and in Baja California.

Habitat

Nassella lepida has only been found in the eastern half of San Nicolas Island, on the northeastern and southeastern escarpments. It grows on north- and south-facing slopes at elevations between 12 and 230 m, and is found primarily between elevations of 24 and 60 m. *Nassella lepida* occurs in the coastal scrub plant community on coastal flats and in arroyo bottoms. It is often found in or near *Opuntia* patches (Fig. 20), where associated species include *Achillea millefolium*, *Achnatherum diegoense*, *Amblyopappus pusillus*, *Astragalus traskiae*, *Atriplex semibaccata*, *Avena barbata*, *A. fatua*, *Bromus hordeaceus*, *B. madritensis* subsp. *rubens*, *Calystegia macrostegia* subsp. *amplissima*, *Coreopsis gigantea*, *Daucus pusillus*, *Dichelostemma capitatum*, *Eriogonum grande* var. *timorum*, *Frankenia salina*, *Galium aparine*, *Gnaphalium bicolor*,

Hemizonia clementina, *Isocoma menziesii*, *Lamarckia aurea*, *Lomatium insulare*, *Lotus argophyllus* var. *ornithopus*, *Lycium californicum*, *Malacothrix saxatilis* var. *implicata*, *Medicago polymorpha*, *Melilotus indicus*, *Mesembryanthemum nodiflorum*, *Opuntia littoralis*, *O. oricola*, *Parietaria hespera*, and *Sonchus oleraceus*.

Status

A total of 10 small populations, ranging in size from a few plants to more than 30 individuals, were found on San Nicolas Island during this survey (Fig. 21). On the other California Channel Islands, *N. lepida* is abundant on the larger islands but rare on some of the smaller ones. For example, it is common on Santa Cruz, Santa Catalina, and San Clemente islands, but is only known from a single collection made in 1939 on Santa Barbara Island. Throughout much of its range on the Channel Islands and on the California mainland, its habitat has been severely degraded and disturbed by grazing animals and other agricultural activities.

Management Suggestions

Habitats of *N. lepida* on San Nicolas Island should be protected from excessive erosion and disturbance. Although populations seen during this survey appear to be healthy, known locations should be revisited at least every 5 years to check the status of populations.

Annotated Bibliography

Abrams, L. 1917. Flora of Los Angeles and Vicinity. Stanford Bookstore, Stanford University, California. 432 p.

Reported *Stipa eminens* (=*S. lepida*) as occasional on dry ridges in the "chaparral belt" near Pasadena and San Diego. Also reported *Stipa eminens andersonii* (=*S. lepida* var. *andersonii*) from the Santa Monica Mountains.

Abrams, L. 1944. Illustrated flora of the Pacific States. Volume I. Ophioglossaceae to Aristolochiaceae. Stanford University Press, Stanford, California. 538 p.

Reported *S. lepida* from open ground in the "Arid Transition Zone" of the Coast Ranges, from central California to Baja California. Flowering times were listed as April–June.

Barkworth, M. E., and J. Everett. 1988. Evolution in the Stipeae: identification and relationships of its monophyletic taxa. P. 251–264 in T. R. Soderstrom et al., editors. Grass Systematics and Evolution. Smithsonian Institution Press, Washington, D.C.

In this preliminary reinterpretation of the Stipeae, *S. lepida* was included in the genus *Nassella* but no formal nomenclatural proposal was made.

Barkworth, M. E. 1990. *Nassella* (Gramineae, Stipeae): revised interpretation and nomenclatural changes. Taxon 39(4):597–614.

Differences between the genera *Achnatherum*, *Nassella*, and *Stipa* were elucidated and the name *N. lepida* was published as a new combination.

Barkworth, M. E. 1993. *Nassella*. P. 1,274–1,276 in J. C. Hickman, editor. The Jepson Manual: Higher Plants of California. University of California Press, Berkeley.

Reported *N. lepida* from northwestern and central western California, the South Coast, the western Transverse Ranges, the western Peninsular Ranges, the California Channel Islands, and Baja California. Habitats listed were dry slopes in chaparral and oak grassland at elevations below 1,700 m.

Beauchamp, R. M. 1986. A flora of San Diego County, California. Sweetwater River Press, National City, California. 241 p.

Reported *S. lepida* as frequent on dry coastal slopes at elevations below 1,200 m in San Diego County. Specific localities listed were De Luz, Rainbow Valley, San Pasqual, Barona Valley, Point Loma, San Diego, and Jacumba. Flowering times were given as March–May.

Crampton, B. 1961. The endemic grasses of the California Floral Province. Leaflets of Western Botany 9:154–158.

Reported *S. lepida* at low elevations in the Coast Ranges from Humboldt County to San Diego County and northern Baja California, and from Tehama and Shasta counties to Mariposa County in the foothills of the Sierra Nevada.

Davidson, A., and G. L. Moxley. 1923. Flora of southern California. Times-Mirror Press, Los Angeles, California. 452 p.

Reported *S. eminens* (=*S. lepida*) as frequent in "the chaparral zone" from San Bernardino to San Diego.

Dedecca, D. M. 1954. Studies on the Californian species of *Stipa*. Madroño 12:129–139.

Reported the results of morphological and anatomical investigations in the California species of the genus and provided a revised identification key for the taxa.

Dunkle, M. B. 1950. Plant ecology of the Channel Islands of California. Allan Hancock Pacific Expeditions 13(3):247–386.

Reported *S. lepida* from San Miguel, Santa Rosa, Santa Cruz, Anacapa, San Nicolas, Santa Catalina, and San Clemente islands.

Eastwood, A. 1929. Studies in the flora of Lower California and adjacent islands. Proceedings of the California Academy of Sciences, Series 4, 18(14):393–484.

Reported *S. lepida* from Cedros Island, citing a collection by Edward Palmer.

Eastwood, A. 1941. The islands of southern California and a list of the recorded plants II. Leaflets of Western Botany 3(3):54–78.

Reported *S. lepida* from Santa Rosa, Santa Cruz, San Nicolas, Santa Catalina, and San Clemente islands and *S. lepida* var. *andersonii* from Santa Rosa and Santa Catalina islands.

Foreman, R. 1967. Observations on the flora and ecology of San Nicolas Island. U.S. Naval Radiological Defense Laboratory, San Francisco, California. Report USNRDL-TR-67-8. 79 p.

Stipa lepida was specifically excluded from this checklist for San Nicolas Island, as the author was unable to locate a voucher specimen to substantiate earlier reports for the island.

Gould, F. W., and R. Moran. 1981. The grasses of Baja California, Mexico. Memoir No. 12. San Diego Society of Natural History, San Diego, California. 140 p.

Reported *S. lepida* var. *lepida* from northern California through the Coast Ranges to Baja California, on rocky, brushy slopes or occasionally in open pine forest. In Baja California Norte, it was listed as "fairly common" in northwestern Baja California below elevations of 600 m, in the Sierra Juarez to elevations of 1,300 m, on Cerro San Juan de Dios at 700 m, on Guadalupe Island at 450 m, and on Cedros Island between elevations of 300 and 1,050 m. In Baja California Sur, it was listed for the north slope of Cerro Azul at 550 m and above Encinos in the Sierra de la Giganta. *S. lepida* var. *andersonii* was listed as locally common near the Johnson Ranch north of Cabo Colonet at an elevation of 25 m.

Hale, G. O. 1941. A Survey of the vegetation of Cedros Island, Mexico. Unpublished M.A. thesis, University of California at Los Angeles, California. 96 p.

Stipa lepida was reported "at middle and higher elevations on slopes in the less arid parts" of Cedros Island. The author noted that "the herbivorous animals of the island have cropped short most of the bunches of this grass, and a panicle is hard to find."

Hitchcock, A.S. 1915. New or noteworthy species. American Journal of Botany 2(6):299–310.

Type description of Stipa lepida from a specimen collected in the Santa Ynez Forest Reserve by Agnes Chase in 1910.

Hitchcock, A. S. 1925. North American species of *Stipa*. Contributions from the U.S. National Herbarium 24 (7): 215–262.

Reported *Stipa lepida* from dry hills, open woods, and rocky slopes from central California to Baja California; collections from Santa Catalina and Cedros islands were among the specimens cited.

Hoffmann, R. 1932. Notes on the flora of the Channel Islands off Santa Barbara, California. Bulletin of the Southern California Academy of Sciences 31(2):46–60.

Reported *S. lepida* as "common on rocky slopes" on Santa Rosa Island.

Junak, S., R. Philbrick, and C. Drost. 1993. A revised flora of Santa Barbara Island. P. 54–112 in M. Daily, editor. Santa Barbara Island. Occasional Paper No. 6 Santa Cruz Island Foundation, Santa Barbara, California.

Reported *N. lepida* from Santa Barbara Island, where it was known from a single collection made in 1939.

Junak, S., T. Ayers, R. Scott, D. Wilken, and D. Young. 1995. A flora of Santa Cruz Island. Santa Barbara Botanic Garden and California Native Plant Society, Santa Barbara and Sacramento, California. 397 p.

Reported *N. lepida* as common on Santa Cruz Island, where it was found at elevations between 30 and 505 m on coastal bluffs, rocky slopes, grassy hillsides, and exposed ridgetops in the coastal scrub, grassland, and pine forest plant communities. It was also reported for all of the other California Channel Islands (i.e., San Miguel, Santa Rosa, Anacapa, Santa Barbara, San Nicolas, Santa Catalina, and San Clemente islands) and for Los Coronados, Guadalupe, and Cedros islands in Mexico. On the mainland, it was reported from most of California west of the Sierra Nevada and Baja California. Flowering times were listed as March–May.

Millspaugh, C. F., and L. W. Nuttall. 1923. Flora of Santa Catalina Island, California. Field Museum of Natural History, Publication No. 212, Botanical Series, 5:1–413.

Reported *S. lepida* (var. *lepida*) from open situations on Santa Catalina Island, citing a specimen from Gallagher's Canyon. Also reported *S. lepida* var. *andersonii* from hillsides and bluffs on the island, citing specimens from Pebble Beach, a hillside in the canyon opposite Chicken Johnny's, and Sugar Loaf.

Moran, R. 1996. The flora of Guadalupe Island, Mexico. Memoirs of the California Academy of Sciences No. 19. 190 p.

Reported *S. lepida* from northern California to southern Baja California, from the California Channel Islands, and from Los Coronados, Cedros, and Guadalupe islands. The author stated that the taxon was not found on Guadalupe Island until 1958 and that it appeared to be localized on the east side south of the middle of the island, on the east slope of El Picacho, and west of the lobster camp.

Munz, P. A. 1935. A manual of southern California botany. Claremont Colleges, Claremont, California. 642 p.

Reported *S. lepida* (var. *lepida*) as occasional on dry cismontane slopes below elevations of 1,220 m in southern California, ranging to central and Baja California and to Santa Catalina and San Clemente islands. Also reported *S. lepida* var. *andersonii* as with the species but less common, and from Santa Rosa Island.

Munz, P. A. 1974. A flora of southern California. University of California Press, Berkeley, California. 1,086 p.

Reported *Stipa lepida* from dry slopes below elevations of 1,220 m in chaparral and coastal sage scrub plant communities. Range was given as northern California to Baja California and the California Channel Islands. Flowering times were listed as March–May.

Munz, P. A., and D. D. Keck. 1963. A California flora. University of California Press, Berkeley, California. 1,681 p.

Reported *S. lepida* from dry slopes below elevations of 1,220 m in chaparral, coastal sage scrub, and coastal prairie plant communities. Range was given as the Coast Ranges from Humboldt County to Baja California and the California Channel Islands. Flowering times were listed as March–May.

Oberbauer, T. A. 1993. Floristic analysis of vegetation communities on Isla de Cedros, Baja California, Mexico. P. 115–131 in F. G. Hochberg, editor. Third California Island Symposium: Recent Advances in Research on the California Islands. Santa Barbara Museum of Natural History, Santa Barbara, California.

Reported *S. lepida* as widespread at middle elevations throughout Cedros Island.

Raven, P. H. 1963. A flora of San Clemente Island, California. Aliso 5(3):289–347.

Reported *S. lepida* as "fairly common" in grassland throughout San Clemente Island.

Raven, P. H., H. J. Thompson, and B. A. Prigge. 1966. Flora of the Santa Monica Mountains, California. 2nd edition. Special Publication No. 2, Southern California Botanists. University of California, Los Angeles. 181 p.

Reported *S. lepida* as common throughout the Santa Monica Mountains, in coastal sage scrub, southern oak woodland, and about the borders of chaparral.

Smith, C. F. 1952. A flora of Santa Barbara. Santa Barbara Botanic Garden, Santa Barbara, California. 100 p.

Reported *S. lepida* var. *andersonii* from coastal bluffs in the Santa Barbara area, and from Santa Rosa and Santa Cruz islands.

Smith, C. F. 1976. A flora of the Santa Barbara region, California. Santa Barbara Museum of Natural History, Santa Barbara, California. 331 p.

Reported *S. lepida* var. *lepida* as "commonly scattered about grassland and into woodland and chaparral in deeper soils of the coast and inland mountains" in the Santa Barbara region and from Anacapa Island. Smith also reported *S. lepida* var. *andersonii* with the species, "apparently in drier situations and perhaps only an ecological form" and from San Miguel, Santa Rosa, Santa Cruz, and Anacapa islands.

Thorne, R. F. 1967. A flora of Santa Catalina Island, California. Aliso 6(3):1–77.

Reported *S. lepida* as common on dry, rocky slopes and bluffs between elevations of 10 and 550 m at locations throughout Santa Catalina Island. Specific localities listed were Renton Mine, Avalon, Gallagher's, Swain's, Middle Ranch, and Cottonwood canyons, the south slope of Mount Orizaba, west of Empire Landing, the Isthmus, and Cherry Valley.

Wallace, G. D. 1985. Vascular plants of the Channel Islands of southern California and Guadalupe Island, Baja California. Natural History Museum of Los Angeles County, Contributions in Science No. 365:1–136.

Reported *S. lepida* for San Miguel, Santa Rosa, Santa Cruz, Anacapa, Santa Barbara, Santa Catalina, San Clemente, and Guadalupe islands. Listed as unsubstantiated for San Nicolas Island.

Wiggins, I. L. 1980. Flora of Baja California. Stanford University Press, Stanford, California. 1,025 p.

Reported *S. lepida* from Humboldt County and the California Channel Islands to dry slopes of the western foothills of Sierras Juarez and San Pedro Martir in Baja California. Flowering times were listed as March–May.

Figure 19. *Nassella lepida*, showing mature inflorescence, on northeastern coastal flats, San Nicolas Island, California (photo taken 24 March 1993).

Figure 20. Habitat of *Nassella lepida*, in *Opuntia* patch on northeastern coastal flats, San Nicolas Island, California (photo taken 24 March 1993).

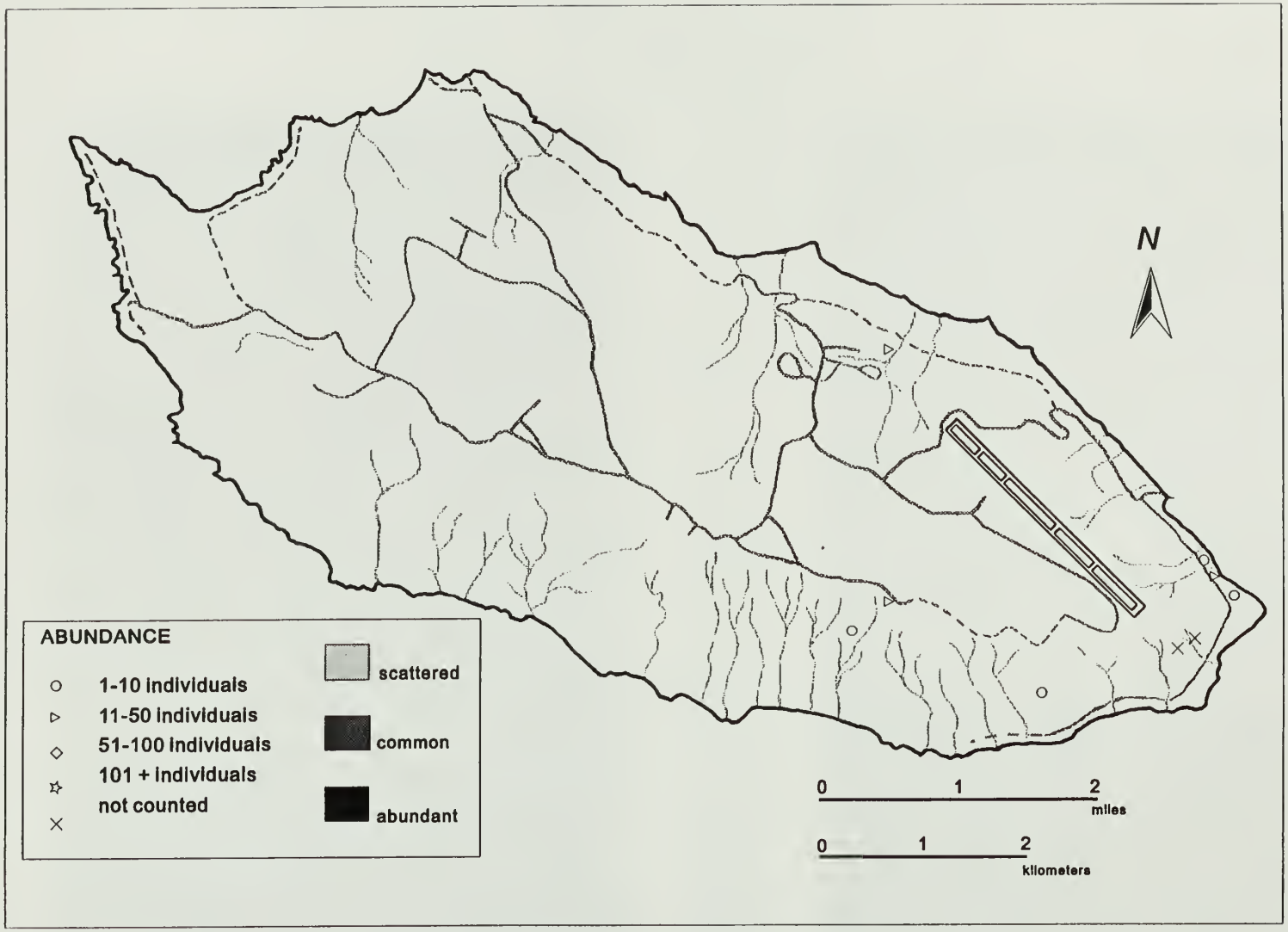

Figure 21. Distribution of *Nassella lepida,* San Nicolas Island, California, 1992–1993.

Botanical name: *Nassella pulchra* (Hitchc.) Barkworth

Common name: Purple needle grass

Family: Poaceae

Listing status

Federal: Not listed
State: Not listed
CNPS: Not listed

Description

Nassella pulchra is a perennial grass, with densely tufted stems and numerous basal leaves (Fig. 22). Culms are several and are 6–10 dm tall. Leaf blades are 1–5 mm wide and are flat to involute. The inflorescence is an open panicle, 1.5–6 dm long with branches 5–8 cm long; branches are distant, slender, spreading, flexuous, bearing 2 to several spikelets. Glumes are unequal, 13–20 mm long, 3-nerved, glabrous, with an acuminate apex. The lemma (excluding the awn) is 7–12 mm long, obscurely 5–7-nerved, usually villosulous, sometimes sparsely pubescent between the veins, and awned at the apex. The awn is 45–90 mm long, twice bent at maturity, and is straight and stiff beyond the second bend.

Taxonomic History and Distinguishing Characteristics

Stipa pulchra was first described by Albert Hitchcock in 1915 and *N. pulchra* was named by Mary Barkworth in 1990. This taxon can be distinguished from the 2 other species in the genus *Nassella* which occur on San Nicolas Island on the basis of floral characteristics. *Nassella lepida* has shorter glumes (5–12 mm vs. 13–20 mm long) and significantly shorter lemmas (4–6.5 mm vs. 7–12 mm long) and awns (20–40 mm vs. 45–90 mm long) than *N. pulchra*. On the other hand, *N. cernua* has longer awns (50–110 mm long vs. 45–90 mm long) than *N. pulchra*; the terminal segment of the awn is flexuous in *N. cernua* versus straight and rigid in *N. pulchra*.

Distribution

The genus *Nassella* comprises about 80 species found in North and South America. Three native and 1 nonnative species are found in California. *Nassella pulchra* occurs throughout much of California on the west side of the Sierra Nevada, on all 8 of the California Channel Islands, on Los Coronados Island, and in northwestern Baja California.

Habitat

On San Nicolas Island, *N. pulchra* is found primarily on open, eroded, or grassy flats, or on gentle slopes. It occurs mostly in the eastern half of the island, on coastal flats, near the edges of the mesa, and on the northeastern escarpment. *Nassella pulchra* grows between elevations of 15 and 275 m on north-, east-, and south-facing slopes and flats. It is found in grasslands and in coastal scrub, where it is often associated with *Opuntia* patches. Associated species include *Achillea millefolium*, *Atriplex semibaccata*, *Avena barbata*, *A. fatua*, *Bromus hordeaceus*, *B. madritensis* subsp. *rubens*, *Coreopsis gigantea*, *Crassula connata*, *Dichelostemma capitatum*, *Erodium cicutarium*, *Galium aparine*, *Hemizonia clementina*, *Isocoma menziesii*, *Lamarckia*

aurea, *Lotus argophyllus* var. *ornithopus*, *Lycium californicum*, *Medicago polymorpha*, *Opuntia oricola*, *O. prolifera*, *Parapholis incurva*, *Sanicula arguta*, *Senecio vulgaris*, *Sonchus oleraceus*, and *Spergularia macrotheca*.

Status

At least 15 populations of *N. pulchra*, ranging in size from 5 individiuals to several hundred plants, were found on San Nicolas Island during this survey (Fig. 23). The species is widespread on the other Channel Islands, but its habitat has been degraded by feral animals and by overgrazing on Santa Rosa, Santa Cruz, and Santa Catalina islands. On the California mainland, it is widespread and fairly common in much of its range, but its habitat has been severely degraded and disturbed by cattle grazing and other agricultural activities in southern California.

Management suggestions

Habitats of *N. pulchra* on San Nicolas Island should be protected from excessive erosion and disturbance. Although populations seen during this survey appear to be healthy, known locations should be revisited at least every 5 years to check the status of the populations.

Annotated bibliography

Abrams, L. 1917. Flora of Los Angeles and Vicinity. Stanford Bookstore, Stanford University, California. 432 p.

Reported *S. setigera* (=*S. pulchra*) as common on the mesas, grassy hills, and in open spaces in the "chaparral belt" in the Los Angeles area.

Abrams, L. 1944. Illustrated flora of the Pacific States. Volume I. Ophioglossaceae to Aristolochiaceae. Stanford University Press, Stanford, California. 538 p.

Reported *S. pulchra* from open ground in the "Arid Transition Zone", mostly in the Coast Ranges of central California and ranging south into Baja California. Flowering times were listed as March–May.

Barkworth, M. E., and J. Everett. 1988. Evolution in the Stipeae: identification and relationships of its monophyletic taxa. P. 251–264 in T. R. Soderstrom et al., editors. Grass Systematics and Evolution. Smithsonian Institution Press, Washington, D.C.

In this preliminary reinterpretation of the Stipeae, *S. pulchra* was included in the genus *Nassella* but no formal nomenclatural proposal was made.

Barkworth, M. E. 1990. *Nassella* (Gramineae, Stipeae): revised interpretation and nomenclatural changes. Taxon 39 (4):597–614.

Differences between the genera *Achnatherum*, *Nassella*, and *Stipa* were elucidated and the name *N. pulchra* was published as a new combination.

Barkworth, M. E. 1993. *Nassella*. P. 1,274–1,276 in J. C. Hickman, editor. The Jepson Manual: Higher Plants of California. University of California Press, Berkeley.

Reported *N. pulchra* for grassland, chaparral, and oak woodland plant communities, at elevations below 1,300 m. Range in California was given as northwestern California, the northern and central Sierra Nevada foothills, the southern Sacramento Valley, central western California, the South Coast, western Transverse Ranges, and the western Peninsular Ranges; the taxon was also reported for the California Channel Islands and for Baja California.

Bartolome, J. W. and B. Gemmill. 1981. The ecological status of *Stipa pulchra* (Poaceae) in California. Madroño 28:172–184.

The authors presented information on the past and present role of *Stipa pulchra* in California grasslands. In permanent transects at the Hopland Field Station in northern California, they found that the density of *S. pulchra* did not increase over a 20-year period in ungrazed areas and that the species was replaced by other perennial grasses and annuals on some plots. They observed that *S. pulchra* germinated more slowly than associated annual plants and that *Stipa* seedlings apparently did not survive the period of rapid spring growth in annual grassland. In pot trials, they found that fewer *S. pulchra* germinated and that plants grew poorly when grown with high densities of *Bromus mollis* and *Festuca megalura*. They concluded that *S. pulchra* is the most common California native grass because it is favored by disturbances that are common now, not because the species dominated the pristine California grassland. They stated that disturbances which reduce associated annuals are important for colonization by *S. pulchra*.

Beauchamp, R. M. 1986. A flora of San Diego County, California. Sweetwater River Press, National City, California. 241 p.

Reported *S. pulchra* as common on dry slopes below elevations of 900 m in western San Diego County. Specific localities listed were Encinitas, Point Loma, Foster, Proctor Valley, and Jacumba. Flowering times were listed as March–May.

Beetle, A. A. 1947. Distribution of the native grasses of California. Hilgardia 17:309–357.

Distribution maps were provided for *Stipa cernua*, *S. lepida*, and *S. pulchra* in the Coast Ranges and Central Valley of California.

Crampton, B. 1961. The endemic grasses of the California Floral Province. Leaflets of Western Botany 9:154–158.

Reported *S. pulchra* at low elevations in oak woodland and chaparral, in the Coast Ranges from Humboldt County to San Diego County and Baja California, on the "islands off the southern California coast," in the foothills surrounding the Central Valley, and in the Sierra Nevada from Shasta County to Mariposa County.

Davidson, A., and G. L. Moxley. 1923. Flora of southern California. Times-Mirror Press, Los Angeles, California. 452 p.

Reported *S. pulchra* as common on adobe banks, on the plains, and in the foothills of the Coast Ranges from Los Angeles to San Diego.

Dedecca, Dalvo M. 1954. Studies on the Californian species of *Stipa*. Madroño 12:129–139.

Reported the results of morphological and anatomical investigations in the California species of the genus and provided a revised identification key for the taxa.

Dunkle, M. B. 1950. Plant ecology of the Channel Islands of California. Allan Hancock Pacific Expeditions 13(3):247–386.

Reported *S. pulchra* for San Miguel, Santa Rosa, Santa Cruz, Anacapa, Santa Barbara, San Nicolas, Santa Catalina, and San Clemente islands.

Eastwood, A. 1941. The islands of southern California and a list of the recorded plants. II. Leaflets of Western Botany 3(3):54–78.

Reported *S. pulchra* for San Miguel, Santa Rosa, Santa Cruz, San Nicolas, Santa Catalina, and San Clemente islands.

Foreman, R. 1967.Observations on the flora and ecology of San Nicolas Island. U.S. Naval Radiological Defense Laboratory, San Francisco, California. Report USNRDL-TR-67-8. 79 p.

Reported *S. pulchra* from San Nicolas Island, where it was found to be "infrequent in open areas of the mesa and escarpment."

Gould, F. W., and R. Moran. 1981. The grasses of Baja California, Mexico. Memoir No. 12. San Diego Society of Natural History, San Diego, California. 140 p.

Reported *S. pulchra* from northern California to Baja California, on dry, brushy or forested slopes below elevations of 1,500 m "in the southern part of the range." In Baja California Norte, it was reported "mostly near the coast" to south of Ensenada, and from South Los Coronados Island.

Hoffmann, R. 1932. Notes on the flora of the Channel Islands off Santa Barbara, California. Bulletin of the Southern California Academy of Sciences 31(2):46–60.

Reported "a few plants" of *S. pulchra* on "a rocky mesa near the east end" of San Miguel Island.

Hull, J. C. and C. H. Muller. 1977. The potential for dominance by *Stipa pulchra* in a California grassland. American Midland Naturalist 97:147–175.

This study examined the potential of *S. pulchra* to exclude *Avena fatua* from the perennial grassland. From field and greenhouse studies, the authors concluded that a synergisitc effect of allelopathic interactions and limitation of available nitrogen was a potential mechanism by which *Avena fatua* is reduced in grasslands dominated by *S. pulchra.*

Junak, S. A., and J. M. Vanderwier. 1990. An annotated checklist of the vascular plants of San Nicolas Island, California. P. 121–145 in Proceedings of the Fifth Biennial Mugu Lagoon/ San Nicolas Island Ecological Research Symposium. Naval Air Station, Point Mugu, California.

Reported *S. pulchra* as rare on San Nicolas Island, where it was found on the southeastern end of the mesa.

Junak, S., T. Ayers, R. Scott, D. Wilken, and D. Young. 1995. A flora of Santa Cruz Island. Santa Barbara Botanic Garden and California Native Plant Society, Santa Barbara and Sacramento, California. 397 p.

Reported *N. pulchra* as common on Santa Cruz Island, where it was found at elevations between 3 and 455 m on coastal bluffs, coastal flats, dry ravines, rocky slopes, grassy hillsides, and exposed ridgetops in the coastal scrub and grassland plant communities. It was also reported for all of the other California Channel Islands (i.e., San Miguel, Santa Rosa, Anacapa, Santa Barbara, San Nicolas, Santa Catalina, and San Clemente islands), Los Coronados Island, and for the California mainland west of the Sierra Nevada to Baja California. Flowering times were listed as March–June.

Millspaugh, C. F., and L. W. Nuttall. 1923. Flora of Santa Catalina Island, California. Field Museum of Natural History, Publication No. 212, Botanical Series, 5:1–413.

Reported *S. pulchra* from "open situations" on Santa Catalina Island.

Munz, P. A. 1935. A manual of southern California botany. Claremont Colleges, Claremont, California. 642 p.

Reported *S. pulchra* as common on dry cismontane slopes below pine belt, ranging from central California to Baja California. The taxon was also reported for Santa Rosa, San Nicolas, Santa Catalina, and San Clemente islands.

Munz, P. A. 1974. A flora of southern California. University of California Press, Berkeley, California. 1,086 p.

Reported *S. pulchra* from dry slopes below 1,525 m in chaparral and coastal sage scrub plant communities. Range was given as northern California to Baja California and the California Channel Islands. Flowering times were listed as March–May.

Munz, P. A., and D. D. Keck. 1963. A California flora. University of California Press, Berkeley, California. 1,681 p.

Reported *S. pulchra* from dry slopes below elevations of 1,525 m in chaparral, coastal sage scrub, and foothill woodland plant communities. Range was given as the Coast Ranges from Humboldt County to Baja California, the Sierran foothills, and the California Channel Islands. Flowering times were listed as March–May.

Nelson, L. L. and E. B. Allen. 1993. Restoration of *Stipa pulchra* grasslands: effects of mycorrhizae and competition from *Avena barbata*. Restoration Ecology 1:40–50.

Field and greenhouse experiments were conducted to determine whether vesicular-arbuscular mycorrhizae affected growth and competition between the native perennial *Stipa pulchra* and the introduced annual *Avena barbata*. *Stipa* showed decreased shoot dry mass and increased root mass when inoculated, while *Avena* showed the opposite response, increased shoot mass and decreased root mass. Mycorrhizal *Avena* also produced more seeds. Mycorrhizae did not alleviate the negative effects of competition of *Avena* on *Stipa*. The authors found the same 3 species of mycorrhizal fungi in annual and perennial grasslands, but their relative composition was different. When inoculum from the 2 grassland types were tested in the field, the fungal species began to revert within 5 months to the species composition found in grasslands of the host plant. The authors concluded that the original fungal species composition may return relatively quickly, once annual grasslands have been revegetated with *S. pulchra*. They also concluded that, in areas where *A. barbata* dominates, inoculation with mycorrhizal fungi alone would not suffice for establishing *S. pulchra*. The usual practices for control of weed competition would still need to be employed to re-establish dominance of *S. pulchra*.

Raven, P. H. 1963. A flora of San Clemente Island, California. Aliso 5(3):289–347.

Reported *S. pulchra* from grassland at the northern end of San Clemente Island and "perhaps" from Mosquito Cove. The author cited voucher specimens from Northwest Harbor, Wilson Cove, and from the vicinity of Mosquito Cove (a specimen from Mosquito Cove was included but was cited as "determination doubtful").

Raven, P. H., H. J. Thompson, and B. A. Prigge. 1966. Flora of the Santa Monica Mountains, California. 2nd ed. Special Publication No. 2, Southern California Botanists. University of California, Los Angeles. 181 p.

Reported *S. pulchra* as occasional throughout most of the Santa Monica Mountains (except the easternmost end), in open grassland, coastal sage scrub, and southern oak woodland plant communities.

Smith, C. F. 1952. A flora of Santa Barbara. Santa Barbara Botanic Garden, Santa Barbara, California. 100 p.

Reported *S. pulchra* as abundant in "many rocky fields along foothills" below elevations of 460 m in the Santa Barbara area, and on all 4 Northern Channel Islands (i.e., San Miguel, Santa Rosa, Santa Cruz, and Anacapa islands).

Smith, C. F. 1976. A flora of the Santa Barbara region, California. Santa Barbara Museum of Natural History, Santa Barbara, California. 331 p.

Reported *S. pulchra* as common in many places about stony foothill grassland along the coast and into inland mountains, becoming a relict in cultivated areas. Also reported for the Northern Channel Islands (i.e., San Miguel, Santa Rosa, Santa Cruz, and Anacapa islands). The author also mentioned a "classic relict stand" of this species "on about 9 acres along Las Tunas Road in foothills northeast of Old Mission Santa Barbara" and stated that "steps to save this area were initiated by [The] Nature Conservancy in January 1974."

Stebbins G. L., and R. M. Love. 1941. An undescribed species of *Stipa* from California. Madroño 6(3):137–141.

Described *S. cernua* and elucidated the differences between the new taxon and *S. pulchra*. The authors also provided a distribution map for the 2 species and discussed putative hybrids between them. The putative hybrids were found to be sterile, while individuals of the parental species were "producing good seed in abundance" nearby.

Thorne, R. F. 1967. A flora of Santa Catalina Island, California. Aliso 6(3):1–77.

Reported *S. pulchra* as frequent on dry, rocky slopes and ridges at elevations between 10 and 425 m on Santa Catalina Island. Specific localities listed were Renton Mine Ridge, Hamilton, Gallagher's, and Toyon canyons, Bulrush Ridge, Little Harbor, and rocky slopes 1.6 k west of Empire Landing.

Wallace, G. D. 1985. Vascular plants of the Channel Islands of southern California and Guadalupe Island, Baja California. Natural History Museum of Los Angeles County, Contributions in Science No. 365:1–136.

Reported *S. pulchra* for San Miguel, Santa Rosa, Santa Cruz, Anacapa, Santa Barbara, San Nicolas, Santa Catalina, and San Clemente islands.

WESTEC Services, Inc. 1978. Survey of archaeological and biological resources of San Nicolas Island. Unpublished report prepared for Pacific Missile Test Center. 51 p., maps and appendices.

Reported *S. pulchra* for San Nicolas Island.

White, K. L. 1967. Native bunchgrass (*Stipa pulchra*) on Hastings Reservation, California.

This study provided a quantitative description of the native bunchgrass stands at Hastings Reservation, a former cattle ranch that had been protected from grazing for 27 years at the time of the study. The author found no significant differences in overall *Stipa* cover when he compared ungrazed plots to grazed plots on an adjacent ranch. He did find, however, that *Stipa* clumps were smaller and more numerous in the grazed areas.

Wiggins, I. L. 1980. Flora of Baja California. Stanford University Press, Stanford, California. 1,025 p.

Reported *S. pulchra* from Humboldt County, the Sierra Nevada foothills, and the California Channel Islands to dry slopes of the coastal foothills in Baja California, where it ranged from chaparral areas to yellow pine woodlands. Flowering times were listed as March–May.

Figure 22. *Nassella pulchra*, showing mature inflorescence, on northeastern coastal flats, San Nicolas Island, California (photo taken 24 March 1993).

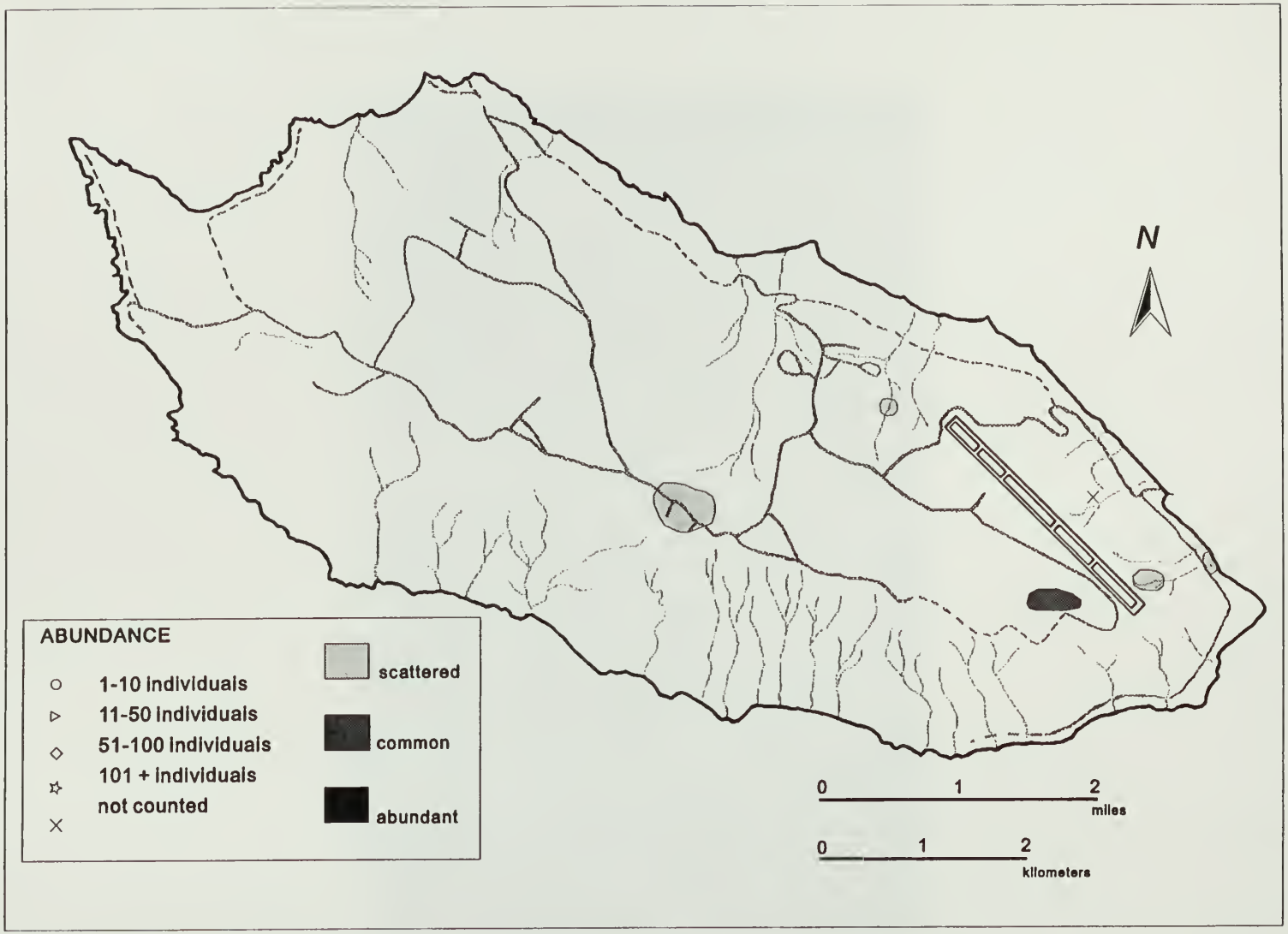

Figure 23. Distribution of *Nassella pulchra,* San Nicolas Island, California, 1992–1993.

Botanical name: *Orobanche parishii* (Jeps.) Heckard subsp. *brachyloba* Heckard

Common name: Short-lobed broomrape

Family: Orobanchaceae

Listing status

Federal: C1
State: C1
CNPS: 1B (Skinner and Pavlik 1994)

Description

This parasitic perennial herb has yellow stems that are simple or few-branched, 8–15 (to 20) cm tall (Figs. 24 and 25). The inflorescence is sub-spicate, moderately dense, and 3–12 cm long. Flowers are sessile or the lower with pedicels to 2 cm long; calyx lobes are 6–10 mm long, purplish; corollas are 15–22 mm long, directed upward or sometimes curving horizontally, sparsely glandular, buff or yellowish, purple-tinged on lips and inner surfaces; corolla lips are 4–6 mm long, with the upper lobes 2–3 cm long, broadly ovate, rounded to pointed apically, erect or slightly spreading; the lower lobes are erect to slightly spreading, ovate to lance-oblong, rounded apically to pointed. Flowering times are April–June (October).

Taxonomic History and Distinguishing Characteristics

Orobanche californica var. *parishii* was named by W. L. Jepson in 1925, from type material collected in the San Bernardino Mountains. *Orobanche parishii* subsp. *brachyloba* was described by Larry Heckard in 1973, from plants collected on San Nicolas Island. According to Heckard, *O. parishii* can be distinguished from other species in the *O. californica* complex by its spicate inflorescence, its short corolla (less than 2.5 cm long) with rounded to blunt apices on the corolla lobes, and by ovate to lance-ovate floral bracts with more than 5 conspicuous parallel veins. The 2 subspecies of *Orobanche parishii* are very similar but subsp. *brachyloba* is generally smaller than subsp. *parishii*; subsp. *brachyloba* has shorter corollas (1.5–2.0 cm long vs. 2.0–2.5 cm long), shorter calyx lobes (usually less than 10 mm long vs. 10 mm or longer), glabrous anthers (vs. hairy or occasionally glabrous), and thick stigma lobes that usually recurve outwardly (vs. thin stigma lobes which are generally spreading but not recruved).

Distribution

The genus *Orobanche*, comprising about 140 species, occurs in the temperate portions of North America, Europe, and Asia. At least 17 taxa are found in California, including 1 species introduced from Europe. Five taxa are found on the California Islands. *Orobanche parishii* subsp. *brachyloba* is found near the mainland coast at elevations less than 305 m between San Luis Obispo County and Baja California. It also occurs on San Miguel, Santa Rosa, Santa Cruz, San Nicolas, and Santa Catalina islands.

Habitat

This broomrape occurs around the perimeter of San Nicolas Island, at elevations between 6 and 275 m, mostly between 30 and 150 m. It is found on a variety of slope exposures, open ridgetops, eroded gullies, and canyon bottoms. *Orobanche parishii* subsp. *brachyloba* is also found in sandy sites on coastal flats. Its most common associate is *Isocoma menziesii*, which is presumably the host plant of this parasitic herb. It occurs in coastal dune, inland dune, and *Isocoma* scrub communities, where common associates include *Abronia umbellata*, *Achillea millefolium*, *Amblyopappus pusillus*, *Ambrosia chamissonis*, *Astragalus traskiae*, *Atriplex californica*, *Bromus madritensis* subsp. *rubens*, *Camissonia cheiranthifolia*, *Coreopsis gigantea*, *Cryptantha maritima* var. *maritima*, *Daucus pusillus*, *Hordeum brachyantherum* subsp. *californicum*, *Lepidium lasiocarpum* var. *lasiocarpum*, *Lomatium insulare*, *Lotus argophyllus* var. *ornithopus*, *Lupinus albifrons*, *Malacothrix polycephala*, *Melilotus indicus*, *Mesembryanthemum crystallinum*, *M. nodiflorum*, *Parapholis incurva*, *Sonchus oleraceus*, and *Spergularia macrotheca*.

Status

More than 40 healthy populations, ranging in size from a few individuals to more than 100 plants, were found in a variety of habitats during this survey (Fig. 26). The presumed host plant, *Isocoma menziesii*, is widespread on San Nicolas Island. The largest island populations of this broomrape apparently occur on San Nicolas.

Populations on other islands are smaller and more widely spaced. *Orobanche parishii* subsp. *brachyloba* is scattered on San Miguel, Santa Rosa, and Santa Cruz islands. It has been collected only once on Santa Catalina Island, at Ben Weston Beach (reported as *O. californica* in Thorne 1967). Ben Weston Beach has been severely disturbed since that collection was made in 1965 and plants have not been seen in recent years (Mark Hoefs, pers. comm. 1995).

Management Suggestions

The habitat of *O. parishii* and its host plant *Isocoma menziesii* should be protected. Disturbance should be minimized to prevent damage to the root connections between parasite and host. This species should be resurveyed at least every 5 years to determine trends in population sizes and locations.

Annotated Bibliography

Beauchamp, R. M. 1986. A flora of San Diego County, California. Sweetwater River Press, National City, California. 241 p.

Reported as rare in San Diego County, where the taxon has been found on sandy coastal beaches at elevations below 10 m at the following locations: Torrey Pines State Reserve, Point Loma, and Silver Strand. Flowering times were listed as May–September. *Atriplex californica* and *Isocoma veneta* were listed as known hosts.

Foreman, R. E. 1967. Observations on the flora and ecology of San Nicolas Island. U.S. Naval Radiological Defense Laboratory, San Francisco, California. Report USNRDL-TR-67-8. 79 p.

This taxon, reported here as an undescribed species related to *O. californica*, was reported from a location along Jackson Highway at an elevation of 215 m and from sandy slopes near the ocean east of Dutch Harbor on San Nicolas Island.

Heckard, L. R. 1973. A taxonomic re-interpretation of the *Orobanche californica* complex. Madroño 22:41–70.

Type description for this taxon, which was described from material collected on San Nicolas Island. The author also reported it from sandy soils near beaches on San Miguel, Santa Rosa, Santa Cruz, and Santa Catalina islands, as well as from the California mainland in San Luis Obispo and San Diego counties and from Baja California. Heckard cited only an historic collection from Baja California, made at El Rosario in 1889. He discussed in detail the taxonomic relationships of the *O. californica* complex and morphological differences between the taxa. He stated that ". . . plants from San Nicolas Island in general possess the most distinctive features in comparison to subsp. *parishii*. Plants from the northern islands along the Santa Barbara Channel are fairly similar but have more pointed corolla lobes." On the other hand, the only collection from Santa Catalina Island approached subsp. *parishii* in almost all of the features used to distinguish the 2 subspecies.

Heckard, L. R. 1993. Orobanchaceae. P. 804–808 in J. C. Hickman, editor. The Jepson Manual: Higher Plants of California. University of California Press, Berkeley, California.

Reported as rare in sandy soil near the ocean at elevations below 300 m, on shrubs such as *Isocoma menziesii*. Reported from central California to Baja California and from the California Channel Islands.

Junak, S. A., and J. M. Vanderwier. 1990. An annotated checklist of the vascular plants of San Nicolas Island, California. P. 121–145 in Proceedings of the Fifth Biennial Mugu Lagoon/ San Nicolas Island Ecological Research Symposium. Naval Air Station, Point Mugu, California.

Reported as scattered to locally common on southeastern and northeastern coastal flats on San Nicolas Island, where it was usually associated with *Haplopappus venetus*.

Junak, S., T. Ayers, R. Scott, D. Wilken, and D. Young 1995. A flora of Santa Cruz Island. Santa Barbara Botanic Garden and California Native Plant Society, Santa Barbara and Sacramento, California. 397 p.

Reported as scarce on Santa Cruz Island, where it was known from the north side of the island near the east end of China Harbor, and was scattered in coastal areas on the south side between West Point and the west end of Pozo Beach. Habitat was listed as coastal flats, loose south-facing slopes, exposed ridgetops, and floodplains. The authors also listed this taxon for San Miguel, Santa Rosa, San Nicolas, and Santa Catalina islands. Distribution on the California mainland was listed as between San Luis Obispo County and northern Baja California. Flowering times were given as June–October and host plant was listed as *Isocoma*.

Munz, P. A. 1974. A flora of southern California. University of California Press, Berkeley, California. 1,086 p.

Reported from sandy soil near beaches at San Diego and on the California Channel Islands. Host plant was listed as *Haplopappus* and flowering time as April–August.

Skinner, M. W., and B. M. Pavlik, editors. 1994. Inventory of Rare and Endangered Vascular Plants of California. Special Publication No. 1, 5th edition. California Native Plant Society, Sacramento, California. 338 p.

Reported for San Miguel, Santa Rosa, Santa Cruz, San Nicolas, and Santa Catalina islands, as well as from San Luis Obispo and San Diego counties and from Baja California. Reported habitat was coastal bluff scrub, coastal scrub, and coastal dunes in sandy sites. Flowering times were listed as May–August.

Smith, C. F. 1976. A flora of the Santa Barbara region, California. Santa Barbara Museum of Natural History, Santa Barbara, California. 331 p.

Reported for San Miguel, Santa Rosa, and Santa Cruz islands. Host plants were listed as *Atriplex*, *Eriogonum*, and *Haplopappus*. Flowering times were given as April–August.

Thorne, R. F. 1967. A flora of Santa Catalina Island, California. Aliso 6(3):1–77.

Reported (as *O. californica*) for Santa Catalina Island, where it was collected only once (in June 1965) at Ben Weston Beach on a low sandy flat behind dunes, attached to roots of *Haplopappus venetus* subsp. *furfuraceus*.

Wallace, G. D. 1985. Vascular plants of the Channel Islands of southern California and Guadalupe Island, Baja California, Mexico. Natural History Museum of Los Angeles County, Contributions in Science No. 365:1–136.

Reported for San Miguel, Santa Rosa, Santa Cruz, San Nicolas, and Santa Catalina islands.

WESTEC Services, Inc. 1978. Survey of archaeological and biological resources of San Nicolas Island. Unpublished report prepared for Pacific Missile Test Center. 51 p., maps and appendices.

Reported as occasional on beach terraces along the eastern and southern portions of San Nicolas Island. Also reported from "many of the Channel Islands and apparently one mainland area in San Diego County where it is now extinct."

Figure 24. *Orobanche parishii* subsp. *brachyloba*, showing habitat, west of Live-forever Canyon, north side of San Nicolas Island, California (photo taken 10 June 1993).

Figure 25. *Orobanche parishii* subsp. *brachyloba*, showing flowers, near Cattail Canyon, southwest side of San Nicolas Island, California (photo taken 12 June 1995).

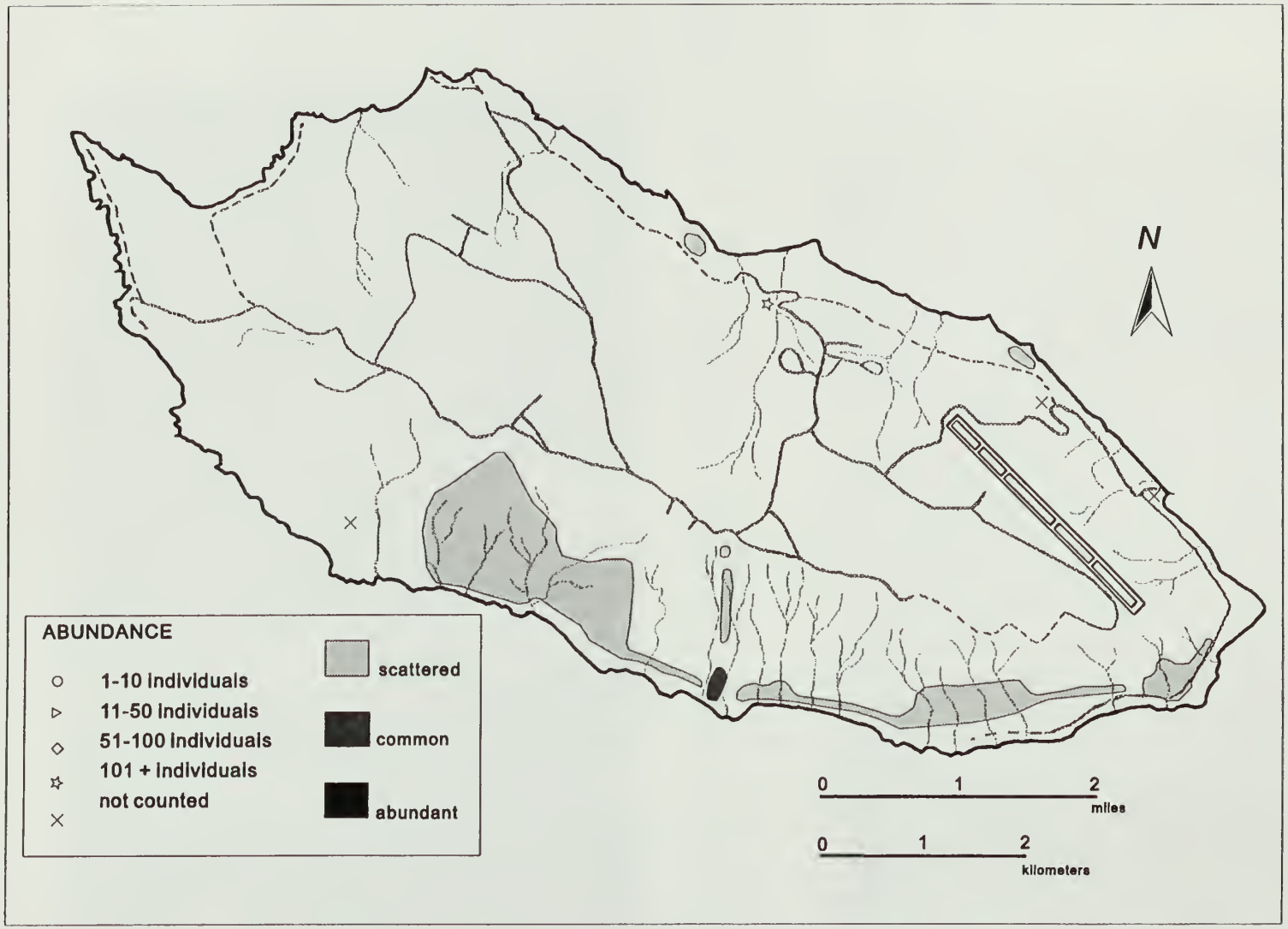

Figure 26. Distribution of *Orobanche parishii* ssp. *brachylobe,* San Nicolas Island California, 1992–1993.

Botanical name: *Trifolium microdon* Hook. & Arn.

Common name: Valparaiso clover

Family: Fabaceae

Listing status

Federal: Not listed
State: Not listed
CNPS: Not listed

Description

Trifolium microdon is a slender, branched, erect annual, which is glabrous and 1–3 dm high (Fig. 27). The stipules are ovate-lanceolate, abruptly acuminate, and entire or somewhat toothed. The leaflets are broadly obcordate to oblanceolate, 0.5–2 cm long, with slender, densely woolly-pubescent peduncles. The involucres are glabrous below. The heads are 6–7 mm broad and the calyx is 4–5 mm long with short, triangular teeth which are abruptly apiculate and ciliate. The corolla exceeds the calyx, is 5–6 mm long, and white to pale rose. Flowering times are March–April.

Taxonomic History and Distinguishing Characteristics

Trifolium microdon was described by Sir William Jackson Hooker and George Arnott in 1833, from plants collected in Valparaiso, Chile. *Trifolium microdon* var. *pilosum* was described by Alice Eastwood in 1898, from plants collected by Blanche Trask on San Nicolas Island. Currently, San Nicolas Island plants are not considered to be distinct from mainland plants and the variety has been submerged in the species in recent treatments (Zohary and Heller 1984; Isely in Hickman 1993). The variety *pilosum* was distinguished from the typical form by the pilose peduncles and involucres; the type description also cited differences in the involucres of the 2 varieties (the teeth of the lobes were reportedly almost equal in var. *pilosum*, while the typical variety had a much longer middle tooth on each lobe). The taxonomic relationships of mainland and island plants are in need of further study.

Distribution

The genus *Trifolium* comprises about 240 species and about 80 infraspecific taxa and occurs widely in temperate to subtropical regions throughout the world. In North American, centers of species diversity are the west coast and the Rocky Mountains (Zohary and Heller 1984). Nine species of *Trifolium* are endemic to California and 1 species (*Trifolium palmeri*) is restricted to the California Islands. *Trifolium microdon* ranges from British Columbia to southern California and is also found in Chile. In California, it occurs near the coast between Del Norte and Santa Barbara counties. *Trifolium microdon* also occurs on San Nicolas and Santa Catalina islands. It has been reported for Santa Cruz Island as well, but the reports for that island were based on misidentified collections (Junak et al. 1995).

Habitat

On San Nicolas Island, *T. microdon* occurs on grassy north-facing slopes and on flats, in grassy

openings between shrubs. It is found in the *Coreopsis* scrub community on the north escarpment at elevations of about 61 m and on the mesa at elevations between 122 and 152 m, where associated plants include *Avena barbata*, *Baccharis pilularis*, *Bromus diandrus*, *B. madritensis* subsp. *rubens*, *Calystegia macrostegia* subsp. *amplissima*, *Castilleja densiflora*, *Claytonia perfoliata*, *Coreopsis gigantea*, *Crassula connata*, *Daucus pusillus*, *Dichelostemma capitatum*, *Erodium cicutarium*, *E. moschatum*, *Galium aparine*, *Isocoma menziesii*, *Lamarckia aurea*, *Lasthenia californica*, *Lotus argophyllus* var. *ornithopus*, *Malacothrix polycephala*, *Medicago polymorpha*, *Sonchus oleraceus*, *Spergularia macrotheca*, *Trifolium microcephalum*, *T. willdenovii*, *Vulpia myuros*, and *V. octoflora*.

Status

Trifolium microdon is extremely rare on the California Channel Islands; it has been seen only sporadically on San Nicolas and Santa Catalina islands. Only 4 extremely small populations of *T. microdon* were found on San Nicolas Island in 1992 (Fig. 28). Previously, the taxon had not been seen on the island for over 90 years (since it was first collected there in 1897). On Santa Catalina Island, *Trifolium microdon* apparently has not been seen since the early 1900s (Millspaugh and Nuttall 1923, Thorne 1967). This species is also rare on the southern California mainland, and populations have apparently been eliminated due to habitat loss. For example, *T. microdon* was last seen in Montecito (just east of Santa Barbara) in 1878 and in the Mesa area of Santa Barbara in 1875.

Management Suggestions

We recommend that all 4 known populations of *T. microdon* on San Nicolas Island be protected from disturbance, as well as potential habitats nearby. We also recommend that this species be resurveyed each year for the next 5 years to determine annual variation in population sizes.

Annotated Bibliography

Abrams, L. 1944. Illustrated flora of the Pacific States. Volume II. Polygonaceae to Krameriaceae. Stanford University Press, Stanford, California. 635p.

Reported *T. microdon* var. *pilosum* as the common form of the species from British Columbia to northwestern California, and "occurring sparingly along the coast to San Nicolas Island."

Brandegee, T. S. 1890. Flora of the Californian Islands. Zoe 1(5):145.

Reported *T. microdon* from Santa Cruz Island.

Dunkle, M. B. 1950. Plant ecology of the Channel Islands of California. Allan Hancock Pacific Expeditions 13(3):247–386.

Reported *T. microdon* from Santa Cruz, Santa Barbara, San Nicolas, and Santa Catalina islands, as well as from British Columbia to central California and from Chile.

Eastwood, A. 1898. Studies in the herbarium and the field II. Notes on the plants of San Nicolas Island. Proceedings of the California Academy of Sciences, Series 3, Botany 1:89–120, 140. Described *T. microdon* var. *pilosum* from plants collected by Blanche Trask on San Nicolas Island. The author also reported *T. microdon* from Santa Cruz and Santa Catalina islands.

Eastwood, A. 1941. The islands of southern California and a list of the recorded plants II. Leaflets of Western Botany 3(3):54–78.

Reported *T. microdon* for Santa Cruz and San Nicolas islands.

Foreman, R. 1967. Observations on the flora and ecology of San Nicolas Island. U.S. Naval Radiological Defense Laboratory, San Francisco, California. Report USNRDL-TR-67-8. 79 p.

Reported *Trifolium microdon* var. *pilosum* for Santa Cruz and San Nicolas islands. On San Nicolas Island, the taxon was reported as rare, known only from collections made in April 1897 by Blanche Trask "in 2 localities on moist slopes."

Greene, E. L. 1887. Studies in the botany of California and parts adjacent. VI. Notes on the botany of Santa Cruz Island. Bulletin of the California Academy of Sciences 2:377–418.

Reported *T. microdon* from Santa Cruz Island.

Hoffmann, R. 1932. Notes on the flora of the Channel Islands off Santa Barbara, California. II. Bulletin of the Southern California Academy of Sciences 31(3):101–120.

Reported *T. microdon* var. *pilosum* for Santa Cruz Island, where the author collected it on an open gravelly ridge in the pine forest at the west end of the island in March 1932.

Isely, D. 1993. *Trifolium*. P. 646–654 in J. C. Hickman, edition. The Jepson Manual: Higher Plants of California. University of California Press, Berkeley.

Reported *T. microdon* from British Columbia to southern California, the California Channel Islands, and South America. Reported as locally common in open, moist or dry sites, which have generally been disturbed. Elevation range was given as 50–1,100 m. The author submerged var. *pilosum* in the species.

Jepson, W. L. 1936. A flora of California. Volume II. California School Book Depository, San Francisco, California. 684 p.

Reported *T. microdon* var. *pilosum* from San Nicolas Island.

Junak, S. A., and J. M. Vanderwier. 1990. An annotated checklist of the vascular plants of San Nicolas Island, California. P. 121–145 in Proceedings of the Fifth Biennial Mugu Lagoon/ San Nicolas Island Ecological Research Symposium. Naval Air Station, Point Mugu,

California.
Reported *T. microdon* var. *pilosum* as rare on San Nicolas Island. The authors stated that the last known collection on the island was made by Blanche Trask in 1897.

Junak, S., T. Ayers, R. Scott, D. Wilken, and D. Young 1995. A flora of Santa Cruz Island. Santa Barbara Botanic Garden and California Native Plant Society, Santa Barbara and Sacramento, California. 397 p.

The authors specifically excluded *T. microdon* and *T. microdon* var. *pilosum* from the known flora of Santa Cruz Island, as they were unable to locate voucher specimens documenting previous reports from the island.

McDermott, L. F. 1910. An illustrated key to the North American species of *Trifolium*. Cunningham, Curtiss, and Welch, San Francisco, California. 325 p.

Reported *T. microdon* var. *pilosum* from British Columbia and from San Nicolas Island.

Millspaugh, C. F., and L. W. Nuttall. 1923. Flora of Santa Catalina Island, California. Field Museum of Natural History, Publication No. 212, Botanical Series, 5:1–413.

Reported *Trifolium microdon* from Santa Catalina Island, citing only 2 specimens collected by Blanche Trask in 1903 and 1907. The authors did not recognize var. *pilosum*, stating that "there appear to be several races in California, but the seed characters hold too strongly to allow . . . varietal segregation."

Munz, P. A. 1935. A manual of southern California botany. Claremont Colleges, Claremont, California.

Reported *T. microdon* as rare in southern California, but found on Santa Cruz, San Nicolas, and Santa Catalina islands. Range on the mainland was given as central California to Baja California, and Chile. The author did not recognize var. *pilosum*, submerging it in the species.

Munz, P. A. 1974. A flora of southern California. University of California Press, Berkeley, California. 1,086 p.

Reported *T. microdon* var. *pilosum* from Santa Cruz and San Nicolas islands. Flowering times were listed as March–May.

Munz, P.A., and D.D. Keck. 1963. A California flora. University of California Press, Berkeley, California. 1,681 p.

Reported *T. microdon* var. *pilosum* from Santa Cruz and San Nicolas islands. Flowering times were listed as March–May.

Smith, C. F. 1952. A flora of Santa Barbara. Santa Barbara Botanic Garden, Santa Barbara, California. 100 p.

Reported *T. microdon* from the Santa Barbara area, citing collections made in 1878, 1895, and 1949; the author also reported this taxon from San Miguel and Santa Cruz islands.

Smith, C. F. 1976. A flora of the Santa Barbara region, California. Santa Barbara Museum of Natural History, Santa Barbara, California. 331 p.

Reported *T. m.* var. *pilosum* from Point Sal on the California mainland, as well as from Santa Cruz Island (in the pine forest east of Christy Ranch) and from San Nicolas Island.

Thorne, R. F. 1967. A flora of Santa Catalina Island, California. Aliso 6(3):1–77.

Reported *T. m.* var. *pilosum* as very rare on Santa Catalina Island; the author cited a single specimen collected in "one locality, canyon" by Blanche Trask in May 1897.

Wallace, G. D. 1985. Vascular plants of the Channel Islands of southern California and Guadalupe Island, Baja California. Natural History Museum of Los Angeles County, Contributions in Science No. 365:1–136.

Reported *T. m.* var. *pilosum* as an insular endemic known from San Nicolas and Santa Catalina islands; the author also listed an unconfirmed report from Santa Cruz Island.

WESTEC Services, Inc. 1978. Survey of archaeological and biological resources of San Nicolas Island. Unpublished report prepared for Pacific Missile Test Center. 51 p., maps and appendices.

Reported *T. m.* var. *pilosum* for San Nicolas Island.

Zohary, M., and D. Heller. 1984. The genus *Trifolium*. The Israel Academy of Sciences and Humanities, Jerusalem, Israel. 606 p.

Reported *T. microdon* from British Columbia to California, and from Chile. The authors did not recognize var. *pilosum*, submerging it in the species without discussion or explanation.

Figure 27. *Trifolium microdon*, on northeastern escarpment, San Nicolas Island, California (photo taken 1 April 1992).

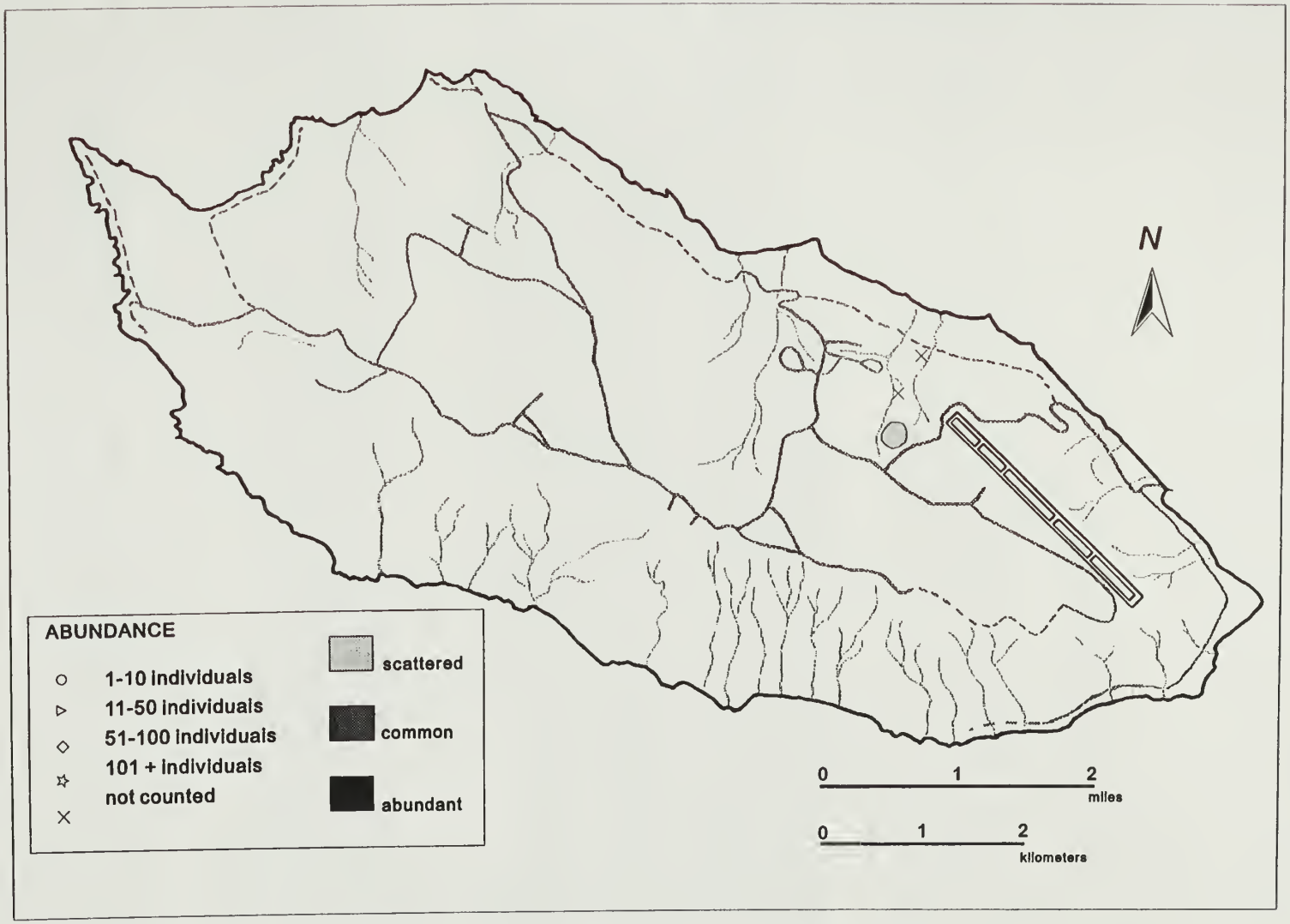

Figure 28. Distribution of *Trifolium microdon,* San Nicolas Island, California, 1992.

Botanical name: *Trifolium palmeri* S.Watson

Common name: Southern island clover

Family: Fabaceae

Listing status

Federal: Not listed
State: Not listed
CNPS: List 4 (Skinner and Pavlik 1994)

Description

Trifolium palmeri is a glabrous, branched annual with erect stems 1–3 dm long (Fig. 29). The stipules are lanceolate, 15–20 mm long, with long, setaceous tips. The leaflets are narrowly elliptic to lance-linear, 1–3 cm long, acute and serrulate, with setaceous teeth. The flower heads are 10–15 mm broad; the calyx is 5–6 mm long; the rose-purple corolla is 6–7 mm long; the pods are 2-seeded. Flowering time is March–May.

Taxonomic History and Distinguishing Characteristics

Trifolium palmeri was described by Sereno Watson in 1876, from plants collected by Edward Palmer on Guadalupe Island. In a 1910 revision of the North American taxa, McDermott treated this taxon as a variety of *T. gracilentum*. Zohary and Heller (1984) followed McDermott's treatment. More recently however, authors of regional floras (e.g., Isely 1993; Moran 1996) have not been consistent in their treatment of this taxon. We are here using the name *Trifolium palmeri*, based on consistent differences in morphology and ecology which have been observed in the field between this insular endemic and the widespread T. *gracilentum*. *Trifolium palmeri* differs from the closely-related *T. gracilentum* in having lance-linear stipules 15–20 mm long (vs. lance-ovate stipules 8–10 mm long) and narrowly elliptic to lance-linear leaflets (vs. obovate to obcordate).

Distribution

The genus *Trifolium* comprises about 320 taxa and occurs widely in temperate to subtropical regions throughout the world. In North America, centers of species diversity are the west coast and the Rocky Mountains (Zohary and Heller 1984). Nine species of *Trifolium* are endemic to California and 1 species (*T. palmeri*) is restricted to the California Islands. *Trifolium palmeri* is found only on Anacapa, Santa Barbara, San Nicolas, Santa Catalina, San Clemente, and Guadalupe islands.

Habitat

On San Nicolas Island, this *Trifolium* is found primarily on north-facing slopes and grassy flats with clay soils. It is most abundant on coastal flats in the northeastern portion of the island, where it occurs in grassy openings between shrubs at elevatons between 15 and 45 m. Small, isolated populations also occur on the mesa, on grassy flats at elevations between 150 and 180 m. *Trifolium palmeri* occurs in *Coreopsis* and *Isocoma* scrub communities, where associated plants include *Achillea millefolium*, *Amblyopappus pusillus*, *Atriplex semibaccata*, *Avena barbata*, *A.*

fatua, *B. hordeaceus*, *B. madritensis* subsp. *rubens*, *Coreopsis gigantea*, *Crassula connata*, *Daucus pusillus*, *Dichelostemma capitatum*, *Erodium cicutarium*, *E. moschatum*, *Hemizonia clementina*, *Isocoma menziesii*, *Lamarckia aurea*, *Lasthenia californica*, *Lotus argophyllus* subsp. *ornithopus*, *Lycium californicum*, *Malacothrix polycephala*, *Medicago polymorpha*, *Melilotus indicus*, *Plantago ovata*, *Sonchus oleraceus*, *Spergularia macrotheca*, *Trifolium microcephalum*, and *Vulpia myuros*.

Status

Trifolium palmeri is an insular endemic found only on Anacapa, Santa Barbara, San Nicolas, Santa Catalina, San Clemente, and Guadalupe islands. Fewer than 10 small populations were found on San Nicolas Island during this study (Fig. 30). A very small population was recently discovered (in the spring of 1996) on West Anacapa Island. It is extremely rare on Santa Catalina Island, where it has apparently only been seen in the 1890s, in 1932, and in 1978. Sizeable, healthy populations have been recorded on Santa Barbara, San Nicolas, San Clemente, and Guadalupe islands in years with significant rainfall.

Management Suggestions

Trifolium palmeri occurs in a relatively small portion of San Nicolas Island and is apparently not seen each year. Areas where it has been seen, as well as potential habitats nearby, should be protected from disturbance. Populations should be resurveyed every year for the next 3–5 years to determine population trends and to measure annual variation in location and density.

Annotated Bibliography

Abrams, L. 1944. Illustrated flora of the Pacific States. Volume II. Polygonaceae to Krameriaceae. Stanford University Press, Stanford, California. 635p.

Reported *T. palmeri* as endemic to "the islands off the coast of southern California and Lower California." Flowering times were listed as April–May.

Berdegue, J. 1957. La Isla de Guadalupe, Mexico. Secretaria de Marina, Mexico. 67 p.

Reported *T. palmeri* from Guadalupe Island.

Brandegee, T. S. 1890. The plants of Santa Catalina Island. Zoe 1(4):107–115.

Reported *T. palmeri* from Santa Catalina Island.

Brandegee, T. S. 1890. Flora of the Californian islands. Zoe 1(5):129–148.

Trifolium palmeri was reported for Santa Catalina, San Clemente, and Guadalupe islands.

Davidson, A., and G. L. Moxley. 1923. Flora of southern California. Times-Mirror Press, Los Angeles, California. 452 p.

Trifolium palmeri was reported for Santa Catalina and San Nicolas islands.

Dunkle, M. B. 1950. Plant ecology of the Channel Islands of California. Allan Hancock Pacific Expeditions 13(3):247–386.

Trifolium gracilentum var. *palmeri* was reported as an insular endemic restricted to Santa Cruz, Santa Barbara, San Nicolas, Santa Catalina, San Clemente, and Guadalupe islands.

Eastwood, A. 1898. Studies in the herbarium and the field. II. Notes on the plants of San Nicolas Island. Proceeding of the California Academy of Sciences, Series 3, Botany 1:89–120, 140.

Trifolium palmeri was reported for San Nicolas Island, where it was found in only 1 locality (a moist slope).

Eastwood, A. 1929. Studies in the flora of Lower California and adjacent islands. Proceedings of the California Academy of Sciences, Series 4, 18(14):393–484.

Trifolium palmeri was reported for Guadalupe Island, where it was " abundant in the middle of the island and around a spring" when Edward Palmer visited.

Eastwood, A. 1941. The islands of southern California and a list of the recorded plants II. Leaflets of Western Botany 3(3):54–78.

Trifolium palmeri was reported for San Nicolas, Santa Catalina, and San Clemente islands.

Foreman, R. E. 1967. Observations on the flora and ecology of San Nicolas Island. U.S. Naval Radiological Defense Laboratory, San Francisco, California. Report USNRDL-TR-67-8. 79 p.

Trifolium palmeri was specifically excluded from this checklist for San Nicolas Island, as the author did not find a voucher specimen to substantiate earlier reports for the island.

Franceschi, F. 1893. Notes on the flora of Guadalupe Island. Zoe 4:130–139.

Reported *T. palmeri* from Guadalupe Island.

Greene, E. L. 1885. Studies in the botany of California and parts adjacent. 4. A catalogue of the flowering plants and ferns of Guadalupe Island. Bulletin of the California Academy of Sciences 1(4):220–228.

Reported *T. palmeri* from Guadalupe Island, where it was collected "in the canyon near the landing." The author reported that it was "much more abundant" than *T. amplectens*.

Isely, D. 1993. *Trifolium*. P. 646–654 in J. C. Hickman, editor. The Jepson Manual: Higher Plants of California. University of California Press, Berkeley.

Trifolium gracilentum var. *palmeri* was reported as uncommon in grassy areas near the ocean at elevations below 15 m. Range was given as the California Channel Islands and Baja California.

Junak, S. A., and J. M. Vanderwier. 1990. An annotated checklist of the vascular plants of San Nicolas Island, California. P. 121–145 in Proceedings of the Fifth Biennial Mugu Lagoon/ San Nicolas Island Ecological Research Symposium. Naval Air Station, Point Mugu, California.

Trifolium palmeri was reported to be endemic to the 4 Southern Channel Islands (i.e., Santa Barbara, San Nicolas, Santa Catalina, and San Clemente islands) and Guadalupe Island. On San Nicolas Island, it was reported as rare, in coastal dunes east of Corral Harbor.

Junak, S., R. Philbrick, and C. Drost. 1993. A revised flora of Santa Barbara Island. P. 54–112 in M. Daily, editor. Santa Barbara Island. Occasional Paper No. 6. Santa Cruz Island Foundation, Santa Barbara, California.

Trifolium palmeri was reported as endemic to the four Southern Channel Islands (i.e., Santa Barbara, San Nicolas, Santa Catalina, and San Clemente islands) and Guadalupe Island. On Santa Barbara Island, the authors reported that it occurs in scattered locations in the eastern portion of the island, on open grassy slopes and in openings between shrubs.

Lyon, W. S. 1886. The flora of our southwestern archipelago II. Botanical Gazette 11:330–336.

Trifolium palmeri was reported for San Clemente Island.

McDermott, L. F. 1910. An illustrated key to the North American species of *Trifolium.* Cunningham, Curtiss, and Welch, San Francisco, California.

Reported *T. gracilentum* var. *palmeri* from San Clemente, Coronados, and Guadalupe islands.

Millspaugh, C. F., and L. W. Nuttall. 1923. Flora of Santa Catalina Island, California. Field Museum of Natural History, Publication No. 212, Botanical Series 5:1–413.

Reported *T. palmeri* from Santa Catalina Island, citing a collection made on "grassy canyon slopes" by Blanche Trask. The authors stated that this taxon was "more common" on San Nicolas and Guadalupe islands. Flowering times were given as April–May.

Moran, R. 1996. The flora of Guadalupe Island, Mexico. Memoirs of the California Academy of Sciences No. 19. 190 p.

Reported this taxon as endemic to Santa Barbara, San Nicolas, Santa Catalina, San Clemente, and Guadalupe islands. Regarding its distribution on Guadalupe Island, the author stated: "In the northeast part of the island it grows mainly in the mouths of the canyons, but from West Anchorage and El Picacho southward it is more widespread and common." The author treated this taxon as *T. palmeri*, stating: "Zohary and Heller (1984) followed McDermott in treating this as a variety of *T. gracilentum*; and it is closely related, differing chiefly in leaf shape. However, Raven (1963:328) considered that on San Clemente

Island the 2 were completely distinct both ecologically and morphologically. And they likewise appear distinct on Guadalupe [Island], in South Esparsa Canyon in 1958 growing side by side . . ."

Munz, P. A. 1935. A manual of southern California botany. Claremont Colleges, Claremont, California. 642 p.

Trifolium gracilentum var. *palmeri* was reported from San Clemente Island and from the "islands of Lower California."

Munz, P. A. 1968. Supplement to a California flora. University of California Press, Berkeley. 224 p.

Reported a chromosome number of 2n=16 for *T. palmeri*.

Munz, P. A. 1974. A flora of southern California. University of California Press, Berkeley. 1,086 p.

Reported *T. palmeri* from "grassy places" on Santa Catalina, San Clemente, and Guadalupe islands.

Munz, P. A., and D. D. Keck. 1963. A California flora. University of California Press, Berkeley. 1,681 p.

Reported *T. palmeri* from grassy places on Santa Catalina, San Clemente, and Guadalupe islands. Flowering times were listed as March–May.

Philbrick, R. N. 1972. The plants of Santa Barbara Island, California. Madroño 21(5), part 2:329–393.

Reported *T. palmeri* as endemic to Santa Barbara, San Nicolas, Santa Catalina, San Clemente, and Guadalupe islands. On Santa Barbara Island, the author stated that this taxon is "currently scattered in the eastern portion of the island."

Raven, P. H. 1963. A flora of San Clemente Island, California. Aliso 5(3):289–347.

Reported *T. palmeri* as endemic to San Nicolas, Santa Catalina, San Clemente, and Guadalupe islands. On San Clemente Island, the author reported that the species is common in grassland at relatively low elevations, often in sandy soil.

Raven, P. H. 1967. The floristics of the California Islands. P. 57–67 in R. Philbrick, editor. Proceedings of the Symposium on the Biology of the California Islands. Santa Barbara Botanic Garden, Santa Barbara, California.

Reported *T. palmeri* as endemic to San Nicolas, Santa Catalina, San Clemente, and Guadalupe islands.

Shreve, F., and I. L. Wiggins. 1964. Vegetation and flora of the Sonoran Desert. 2 volumes. Stanford University Press, Stanford, California. 1,740 p.
Reported *T. palmeri* from grassy slopes on San Clemente and Guadalupe islands. Flowering times were listed as March–May.

Skinner, M. W., and B. M. Pavlik, editors. 1994. Inventory of rare and endangered vascular plants of California. Special Publication No. 1, 5th edition. California Native Plant Society, Sacramento, California. 336 p.

Reported *T. gracilentum* var. *palmeri* from Santa Barbara, San Nicolas, Santa Catalina, San Clemente, and Guadalupe islands. The author stated that this taxon was rediscovered on San Nicolas and Santa Catalina islands in 1978 (it had previously been thought that the taxon was extinct on those 2 island) and that it was common on San Nicolas Island in 1993. Coastal bluff scrub and valley and foothill grassland were listed as the plant communities in which the taxon has been found.

Smith, J. P. Jr., and K. Berg. 1988. Inventory of rare and endangered vascular plants of California. Special Publication No. 1, 4th edition. California Native Plant Society, Sacramento, California. 168 p.

Reported *T. palmeri* from Santa Barbara, San Clemente, and Guadalupe islands, and listed the taxon as "presumed extinct" on San Nicolas and Santa Catalina islands. Coastal bluff scrub and valley and foothill grassland were listed as the plant communities in which the taxon has been found.

Thorne, R. F. 1967. A flora of Santa Catalina Island, California. Aliso 6(3):1–77.

Reported *T. palmeri* as an insular endemic found on San Nicolas, Santa Catalina, San Clemente, and Guadalupe islands. On Santa Catalina Island, the author stated that it was a very rare annual that had not been collected recently. Thorne cited a single collection from the island, made on a sunny hillside west of Isthmus Harbor made by C. B. Wolf in May 1932.

Thorne, R. F. 1969. A supplement to the floras of Santa Catalina and San Clemente islands, Los Angelas Country, California. Aliso 7(1):73–83.

Listed *T. palmeri* as an associate of *Triteleia clementina* on San Clemente Island.

Trask, B. 1899. Field notes from Santa Catalina Island. Erythea 7:135–146.

Reported *Trifolium palmeri* as frequent on Santa Catalina Island.

Trask, B. 1904. Flora of San Clemente Island. II. Bulletin of the Southern California Academy of Sciences 3:90–95.

Reported for San Clemente Island, where it was common and grew "nearer the sea than *T. gracilentum* or *T. tridentatum.*"

Vasey, G., and J. N. Rose. 1890. List of plants collected by Dr. Edward Palmer in Lower California in 1889. Contributions of the U.S. National Herbarium 1(1):9–28.

Reported *T. palmeri* from Guadalupe Island. It was found to be "quite common on the south end in wet sand in canyons" and "very common in large masses in canyons and plains at the north end". The authors further stated that "the plant is widely distributed over the island, and forms the main food supply for the goats."

Wallace, G. D. 1985. Vascular plants of the Channel Islands of southern California and Guadalupe Island, Baja California. Natural History Museum of Los Angeles County, Contributions in Science No. 365:1–136.

Reported for Santa Barbara, San Nicolas, Santa Catalina, San Clemente, and Guadalupe islands.

Watson, S. 1876. Botanical contributions. Proceedings of the American Academy of Arts and Sciences 11:105–148.

Trifolium palmeri was described here, from plants collected by Edward Palmer on Guadalupe Island. The author reported that this new species was "rather adundant in the middle of the island among rocks and trees on hillsides."

Wiggins, I. L. 1980. Flora of Baja California. Stanford University Press, Stanford, California. 1,025 p.

Reported from grassy hillsides, bluffs, and mesas on the Baja California peninsula and Guadalupe Island; also reported for Santa Catalina and San Clemente islands.

Figure 29. *Trifolium palmeri*, on northeastern coastal flats, San Nicolas Island, California (photo taken 24 March 1993).

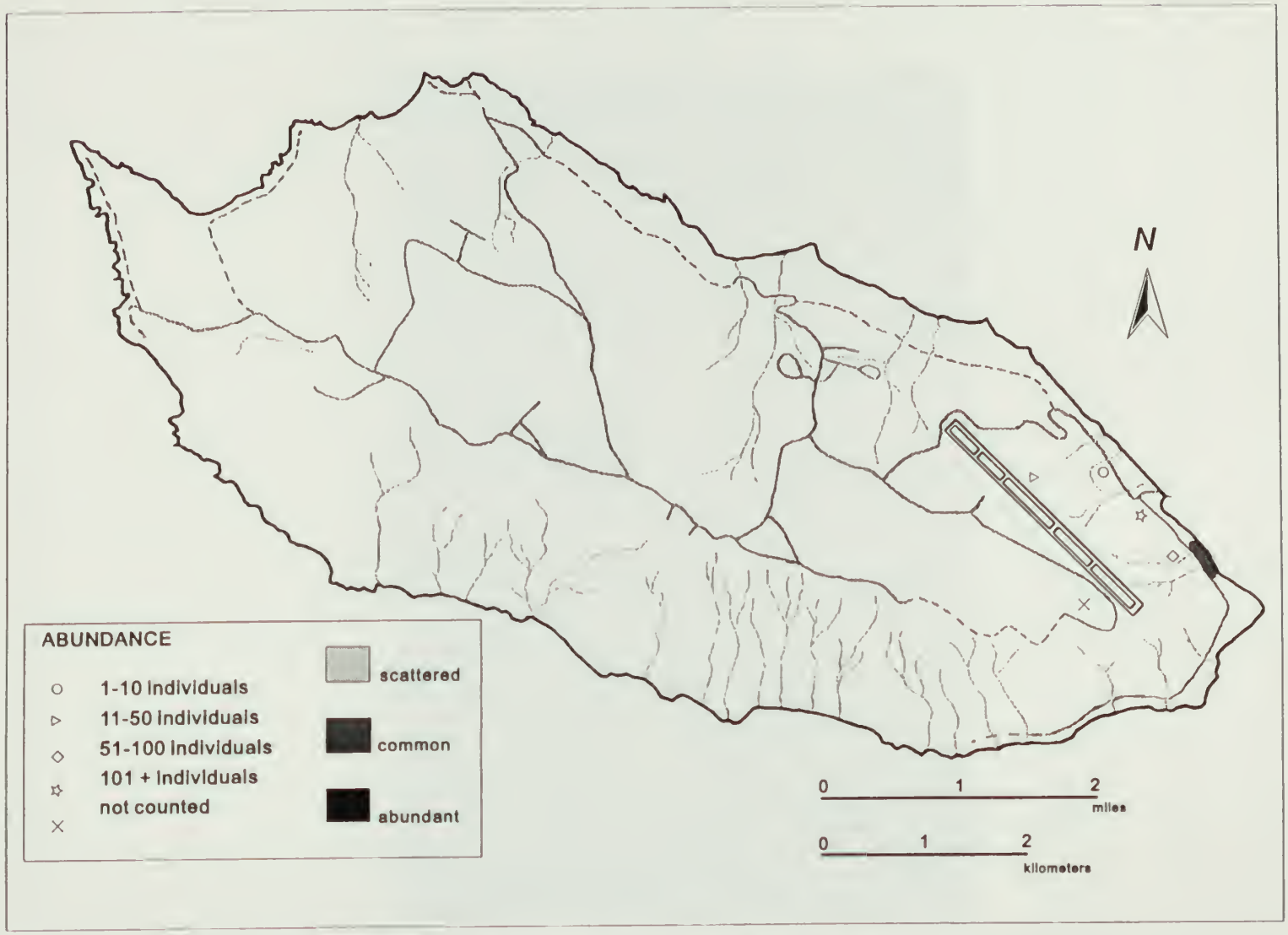

Figure 30. Distribution of *Trifolium palmeri*, San Nicolas Island California, 1992–1993.

Appendix

Definition of Endangered, Threatened and Rare Taxa

Federal

Endangered Species Act of 1973 (PL-93-205) and Federal Register of 21 February 1990.

Endangered

Any taxon (principally species, but may include subspecies) that is in danger of extinction throughout all or a significant portion of its range.

Threatened

Any taxon that is likely to become endangered within the foreseeable future throughout all or a significant portion of its range.

Category 1

Any taxon for which the U.S. Fish and Wildlife Service presently has sufficient information on hand to support the biological appropriateness of its being listed as threatened or endangered.

Because of the large number of such species, relatively low funding levels, and the need to gather data on environmental and economic impacts of listings, it is anticipated that the official listing of these will take several years.

Category 2

Any taxon for which the U.S. Fish and Wildlife Service has less information than for those above, but sufficient information to indicate that it is probable that additional information would lead to the service listing it as threatened or endangered.

All of these taxa require further population biology and sometimes genetic research to fill the gap. Since there is little funding for such studies, these species are being processed at a very slow rate.

Category 3c

Any taxon that is no longer being considered for listing as threatened or endangered.

State

California Endangered Species Act of 1984, amended in 1990.

Endangered

A native species or subspecies of bird, mammal, fish, amphibian, reptile, or plant that is in serious danger of becoming extinct throughout all or a significant portion of its range, due to one or more causes, including loss of habitat, change in habitat, overexploitation, predation, competition, or disease.

Threatened
A native species or subspecies of bird, mammal, fish, amphibian, reptile, or plant that, although not presently threatened with extinction, is likely to become endangered in the foreseeable future in the absence of special protection and management efforts.

Candidate Species
A native species or subspecies of bird, mammal, fish, amphibian, reptile, or plant that the California Fish and Game Commission has formally noticed as being under review by the California Department of Fish and Game for addition to either the list of endangered or the list of threatened species.

California Native Plant Society
[CNPS] (Smith and Berg 1988)

List 1A
Taxa that are presumed to be extinct in California

List 1B
Taxa that are rare, threatened, or endangered in and outside California.

List 2
Taxa that are rare, threatened, or endangered in California, but not outside California.

List 3
Taxa for which there are insufficient data to make a determination of status.

List 4
Taxa with limited distributions, but not rare, threatened, or endangered.

Clemson University
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As the nation's principal conservation agency, the U.S. Department of the Interior has responsibility for most of our nationally owned public lands and natural and cultural resources. This includes fostering wise use of our land and water resources, protecting fish, wildlife and plants, preserving the environmental and cultural values of national parks and historic places, and providing for enjoyment of life through outdoor recreation. The Department assesses our energy and mineral resources and works to ensure that their development is in the best interests of all our people. The Department also has a major responsibility for American Indian reservation communities and for people who live in island territories under U.S. administration.